



December 2018

DEFENSE SCIENCE AND TECHNOLOGY

Actions Needed to Enhance Use of Laboratory Initiated Research Authority

Accessible Version

Why GAO Did This Study

Congress created several authorities that provide DOD research labs with ways to increase efficiency and foster innovation.

Senate report 114-255 contained a provision for GAO to study governance models used by federal labs. This report evaluates DOD labs' use of authorities to foster innovation and efficiency.

GAO selected four authorities that recent work on best practices for science and technology management and expedited defense lab hiring have shown to be the most crucial for supporting innovation; administered a survey to 44 lab directors to gain insight into their use of the authorities; interviewed key lab officials and contractors; and reviewed relevant policies and guidance.

What GAO Recommends

GAO is making three recommendations to enhance DOD's use of laboratory initiated research authority, including that the Air Force assess potential accounting system improvements, the Navy clarify how labs can use the authority for infrastructure improvements, and the Army assess its policy to determine whether changes are needed to remove disincentives for labs to use the authority. DOD concurred with the recommendations.

View [GAO-19-64](#). For more information, contact Michael J. Sullivan at (202) 512-4841 or sullivanm@gao.gov.

DEFENSE SCIENCE AND TECHNOLOGY

Actions Needed to Enhance Use of Laboratory Initiated Research Authority

What GAO Found

Congress has provided the Department of Defense's (DOD) research labs with several authorities to enhance management and operations. Four authorities that GAO examined provide lab directors with greater ability to make their own decisions regarding the funding of projects, hiring, lab management, and purchasing of equipment or services.

- 1. Laboratory initiated research authority.** This authority, as implemented, provides labs with a means to fund new science and technology projects that they consider a priority. Labs may use a percentage of all funds available to the lab and are permitted to charge customers of the lab a percentage fee of the costs for activities performed by the lab for the customer.
- 2. Direct hire authority.** This authority enables labs to compete with private industry for high-quality talent. For example, it provides for streamlined hiring of applicants with relevant advanced degrees, or students enrolled in science, technology, engineering, and mathematics programs.
- 3. Laboratory enhancement pilot program authority.** This authority generally allows lab directors to propose alternative methods that might lead to more effective lab management, and waive certain policies or procedures that might affect implementation of these methods.
- 4. Micro-purchase authority.** This authority raises the threshold for small purchases for DOD research lab activities from \$3,500 to \$10,000 to facilitate acquisitions.

While labs have used these authorities, their use has sometimes been limited, particularly with the laboratory initiated research authority. DOD lab directors at Air Force, Navy, and Army cited several obstacles that impede wider use of that authority, specifically:

Air Force: Financial management officials at the Air Force stated that the service's accounting system does not currently have an automated capability to transfer the allowable percentage fee of costs to a central account at the Air Force Research Laboratory. This lack of capability, officials noted, creates a significant administrative burden related to charging these fees.

Navy: In fiscal year 2017, Navy labs invested \$7.3 million in lab infrastructure projects, compared to \$32.9 million and \$53.7 million at the Air Force and Army, respectively. Navy lab officials told us that they were restricted in their use of infrastructure funds available under the laboratory initiated research authority due to a lack of clear guidance as to whether and how to use this authority within the Capital Investment Program of the Navy Working Capital Fund.

Army: The Army requires its labs to use a similar percentage of funds from two sources: (1) what it refers to as directly appropriated funds and (2) funds labs charge for customer activities. Some Army lab directors reported assessing a lower rate on customer funds than allowed so as not to drive customers away. The labs then generally charge a lower than desired rate on their directly appropriated funds, which further constrains the total funding available to them.

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Abbreviations

DOD	Department of Defense
DFARS	Defense Federal Acquisition Regulation Supplement
Energy	Department of Energy
FAR	Federal Acquisition Regulation
FFRDC	federally funded research and development center
MIT	Massachusetts Institute of Technology
NASA	National Aeronautics and Space Administration
NNSA	National Nuclear Security Administration
OSD	Office of the Secretary of Defense
R&D	research and development
STEM	Science, technology, engineering, and mathematics
STE	staff years of technical effort
UARC	university affiliated research center
USD (R&E)	Under Secretary of Defense for Research and Engineering

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December 20, 2018

Congressional Committees

For more than 90 years, the Department of Defense (DOD) has relied on its science and technology reinvention laboratories (lab) to develop technologies intended to maintain U.S. superiority on the battlefield. The defense lab enterprise—consisting of 63 military service labs, warfare centers, and engineering centers—is critical to strengthening the military services’ competitive edge and offsetting technological advances of potential adversaries. These labs develop innovations to counter existing and emerging threats, and accelerate the delivery of technical capabilities to the warfighter. Beyond its labs, DOD sponsors federally funded research and development centers (FFRDC) and university affiliated research centers (UARC) that provide additional technology development activities integral to the department’s needs.

We have previously reported that defense labs have struggled to consistently identify, develop, and deliver innovative technologies quickly.¹ Moreover, these defense labs have encountered problems with recruiting and retaining a high-quality workforce and maintaining their facilities, according to the Defense Science Board.² Congress has provided DOD with several tools and mechanisms, which we refer to in this report as authorities. The various authorities have provided laboratory directors with greater ability to make their own decisions regarding laboratory administration and management, funding allocations and personnel. One of these authorities also provides for labs to seek waivers to existing DOD policies that are believed to stifle innovation and flexibility. Senate report 114-255 accompanying the National Defense Authorization Act for Fiscal Year 2017 noted the importance of these authorities as a step toward accelerated innovation and flexibility. It included a provision for us to study the lab governance used by DOD and

¹GAO, *Defense Technology Development: Technology Transition Programs Support Military Users, but Opportunities Exist to Improve Measurement of Outcomes*, [GAO-13-286](#) (Washington D.C.: Mar. 7, 2013).

²See, for example, Defense Science Board, *Defense Research Enterprise Assessment*, (Washington, D.C.: Jan. 25, 2017). The Defense Science Board is a Federal Advisory Committee that provides independent advice to the Secretary of Defense and recommendations on matters relating to DOD’s scientific and technical enterprise.

other agencies. In this report, we (1) evaluate how defense labs have used selected legislative authorities to foster innovation and efficiency and identify what barriers, if any, impede their use; (2) identify and describe governance models used by selected DOD-sponsored FFRDCs and UARCs; and (3) identify and describe governance models used by selected non-defense labs, specifically at the Department of Energy (Energy) and National Aeronautics and Space Administration (NASA).

For each of our three objectives, we interviewed key agency and lab officials as well as contractor representatives. To evaluate how defense labs have used selected legislative authorities and identify any barriers that have impeded their use, we took inventory of the over 20 lab-related authorities that have been enacted since 1994. From that list, we selected for review four specific authorities that our recent work on best practices for science and technology management and expedited defense lab hiring have shown are, or have the potential to be, the most crucial for supporting DOD labs' innovation missions.³ We then reviewed DOD-wide and military service-specific policies as well as documents and reports that detailed implementation of the selected authorities. We also administered a survey to 44 lab directors (or their equivalents) to collect information on their use of the four authorities, their perceptions about each authority's effectiveness, and any perceived barriers to each authority's use. A total of 31 lab directors completed and returned surveys to us, which constituted a response rate of 71 percent. For the two authorities in our review that have been in place the longest, we analyzed relevant DOD data on lab personnel hiring and infrastructure investments. Based on our reviews of supplementary documentation and interviews with agency officials, we determined that these survey data were sufficiently reliable for the purposes of our analysis.

To identify and describe governance models used by DOD-sponsored research centers, we focused our review on the three FFRDCs designated as research and development labs as well as all 13 UARCS sponsored by DOD entities. We reviewed relevant sections of the Federal Acquisition Regulation (FAR) that cover FFRDCs as well as DOD policies and guidance for working with FFRDCs and UARCs. Further, we

³GAO, *DOD Personnel: Further Actions Needed to Strengthen Oversight and Coordination of Defense Labs' Hiring Efforts*, [GAO-18-417](#) (Washington, D.C.: May 30, 2018); and *Defense Science and Technology: Adopting Best Practices Can Improve Innovations Investments and Management*, [GAO-17-499](#) (Washington D.C.: June 29, 2017).

reviewed selected FFRDC and UARC contracts and performance assessments to gain additional visibility on how these entities operate.

To identify and describe governance models by selected research entities at Energy and NASA, we identified 17 Energy labs and 4 NASA research centers conducting basic and applied research similar to defense labs. We chose to focus on Energy and NASA because in our August 2016 GAO Technology Readiness Assessment Guide, we drew heavily from DOD, Energy, and NASA for best practices, terminology, and examples.⁴ Further, DOD, Energy, and NASA represented three of the top four agencies with the highest federal research and development spending on average from fiscal years 2015 to 2017. We did not include the fourth agency—the National Institutes of Health—in our review because it is not as similar to DOD. We reviewed relevant sections of the FAR that cover these research entities, along with key agency policies and guidance on how these entities operate. More information about our objectives, scope, and methodology can be found in appendix I.

We conducted this performance audit from July 2017 to December 2018 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

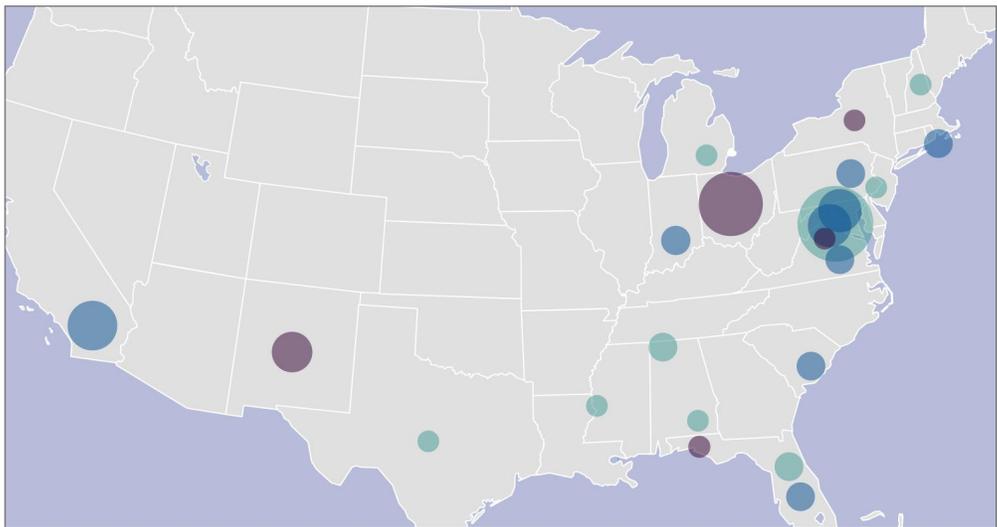
Background

The defense lab enterprise consists of 63 labs, warfare centers, and engineering centers across the Departments of the Army, Navy, and Air Force, as shown in Figure 1 below.⁵ About 50,000 federally employed scientists and engineers work at these defense labs to support warfighter needs and develop transformative capabilities. Defense labs are managed and operated within the military service chain of command.

⁴GAO, *GAO Technology Readiness Assessment Guide: Best Practices for Evaluating the Readiness of Technology for Use in Acquisition Programs and Projects—Exposure Draft*, [GAO-16-410G](#) (Washington, D.C.: Aug. 11, 2016).

⁵We refer to DOD's labs, warfare centers, and engineering centers collectively as defense labs in this report.

Figure 1: Department of Defense Laboratory Enterprise Overview



- Department of the Air Force**
- Air Force Research Laboratory Headquarters
 - Materials and Manufacturing Technology Directorate (TD)
 - Space Vehicles TD
 - Sensors TD
 - Information TD
 - Aerospace Systems TD
 - Munitions TD
 - 711th Human Performance Wing
 - Directed Energy TD
 - Air Force Office of Scientific Research

Department of the Navy

- Office of Naval Research
- Naval Research Laboratory
- Naval Surface & Undersea Warfare Centers
- Naval Surface Warfare Center Carderock
- Naval Surface Warfare Center Corona
- Naval Surface Warfare Center Crane
- Naval Surface Warfare Center Dahlgren
- Naval Surface Warfare Center Indian Head
- Naval Surface Warfare Center Panama City
- Naval Surface Warfare Center Philadelphia
- Naval Surface Warfare Center Port Hueneme
- Navy Undersea Warfare Center Newport
- Naval Air Warfare Center, Aircraft Division
- Naval Air Warfare Center, Weapons Division
- Space and Naval Warfare (SPAWAR) Systems Center, Atlantic Division
- SPAWAR Systems Center, Pacific Division

Department of the Army

- Army Research Laboratory
- Army Edgewood Chemical Biological Center
- Army Armament Research, Development, and Engineering Center
- Army Natick Soldier Research, Development and Engineering Center
- Army Aviation & Missile Research, Development and Engineering Center
- Engineer Research and Development Center
- Army Communications-Electronics Research, Development, and Engineering Center
- Army Tank Automotive Research, Development, and Engineering Center
- Army Research Institute for the Behavioral and Social Sciences
- Space and Missile Defense Command Technical Center
- Medical Research and Materiel Command
- Army Aeromedical Research Laboratory
- Army Institute of Surgical Research
- Army Medical Research Institute of Chemical Defense
- Army Medical Research Institute of Infectious Disease
- Army Research Institute of Environmental Medicine
- Walter Reed Army Institute of Research

Source: Department of Defense Laboratories office. | GAO-19-64

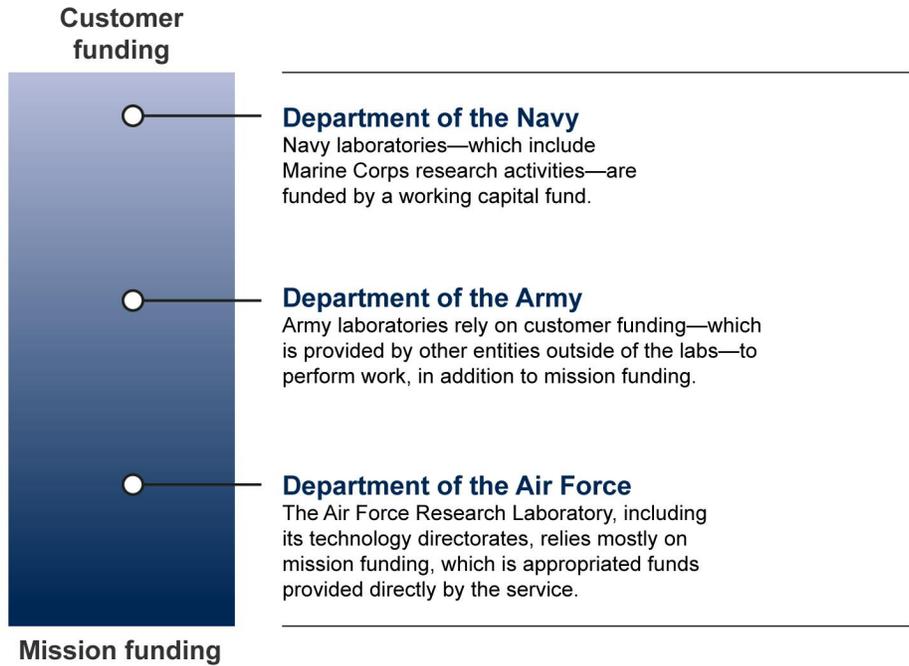
Defense Lab Funding Models

DOD budgets for technology and product development activities under its research, development, test, and evaluation budget, which DOD groups into seven budget activity categories for its annual budget estimates. Air

Force and Army labs rely on appropriated funding provided from the service—often referred to as mission funding—or from customers (or some combination thereof). Customers, such as program offices, provide funding to defense labs for technology development activities and related research. The Air Force and Army funding structure is in contrast to Navy research and development activities, which operate under the Navy Working Capital Fund—a revolving fund that finances Department of the Navy activities on a reimbursable basis.⁶ Under this funding model, the Navy employs a Capital Investment Program to obtain capital assets, including minor military construction projects for labs. The program provides the framework for planning, coordinating, and controlling Navy working capital funds and expenditures to obtain capital assets. Figure 2 illustrates the varying funding models used by the military service labs.

⁶A revolving fund is a fund established by Congress to finance a cycle of businesslike operations through amounts received by the fund. A revolving fund charges for the sale of products or services and uses the proceeds to finance its spending, usually on a self-sustaining basis. Instead of recording the collections in receipt accounts, the budget records the collections and the outlays of revolving funds in the same account. A revolving fund is a form of permanent appropriation. GAO, *A Glossary of Terms Used in the Budget Process*, GAO 02-734SP (Washington DC: Sept. 2005). Within this structure, decision makers at all levels are more aware of the costs of goods and services by making military operating units pay for the support they receive.

Figure 2: Research and Development Laboratory Funding Models within the U.S. Military Services



Source: GAO analysis of DOD documentation. | GAO-19-64

Other DOD-Sponsored Science and Technology Entities

In addition to its labs, DOD sponsors other entities to provide for its technology development needs. Specifically, these include:

- FFRDCs are operated by universities, other not-for-profit or nonprofit organizations, or private firms under long-term contracts and provide special research and development services that generally cannot be readily satisfied by government personnel or private contractors. For example, the Massachusetts Institute of Technology Lincoln Laboratory develops key radar and electronic warfare technologies for integrated air and missile defense systems. In addition, the Software Engineering Institute operated by Carnegie Mellon University provides cybersecurity solutions for defense entities. While DOD sponsors 10 FFRDCs in total, it designates 3 FFRDCs as research and development labs, which maintain long-term competencies in key technology areas. In addition to these, DOD sponsors 2 systems engineering and integration FFRDCs and 5 studies and analysis FFRDCs.

-
- UARCs provide specialized research and development services similar to FFRDCs and also operate under long-term contracts. However, unlike FFRDCs, DOD requires that UARCs be affiliated with a university. Generally, UARCs may not compete against industry in response to a competitive Request for Proposals for development or production that involves engineering expertise. DOD currently sponsors 13 UARCs.

Key Offices Responsible for Oversight of Defense Labs

Key DOD offices provide oversight to the defense labs:

- The Under Secretary of Defense for Research and Engineering (USD(R&E))—the principal advisor to the Secretary of Defense for research, engineering, and technology development activities and programs—serves as DOD’s chief technology officer. The powers and duties of this office include establishing policies and providing oversight for DOD’s research, engineering, and technology development activities.
- The Defense Laboratories Office—within the Office of the USD(R&E)—supports DOD’s research and engineering mission by helping to ensure comprehensive department-level insight into the activities and capabilities of the defense labs. This office carries out a range of core functions related to the defense labs, including analysis of capabilities, alignment of activities, and advocacy.

Defense Lab Authorities

Congress has granted authorities that address hiring, infrastructure, and technology transition challenges to defense labs since 1995. These authorities provide defense lab directors with certain flexibilities within the established legal framework to manage their operations. While Congress has provided a number of authorities, in this report we focus on four authorities that our prior work on best practices in science and technology management and expedited lab hiring has shown are, or have the potential to be, the most crucial for supporting innovation within DOD labs.⁷

⁷[GAO-17-499](#) and [GAO-18-417](#).

- **Laboratory Initiated Research Authority.** This authority provides lab directors with the means to fund some of the research projects that the lab will pursue. The authority provided in Section 219 of the Duncan Hunter National Defense Authorization Act for Fiscal Year 2009, as implemented, provides lab directors with a means to fund projects they consider to be a priority in four allowable categories: (1) basic and applied research, (2) technology transition, (3) workforce development, and (4) revitalization, recapitalization, or repair or minor construction of lab infrastructure.⁸ These projects include those not specifically tied to defined requirements, outside of the normal 2-year budget planning process. The authority directs the Secretary of Defense to establish mechanisms under which lab directors may use an amount of funds equal to not less than 2 percent and not more than 4 percent of all funds available to the defense lab for projects under the four allowable categories. Further, lab directors are permitted to obtain additional funding by charging customers a fixed percentage fee that may not exceed 4 percent of costs.⁹
- **Direct Hire Authorities.** These authorities provide lab directors with a streamlined and accelerated hiring process. Congress has enacted four types of direct hire authorities since 2008, which help labs compete with private industry and academia for high-quality scientific, engineering, and technical talent.¹⁰ Specific types of direct hire authorities include hiring: (1) candidates with advanced degrees; (2) candidates with bachelor's degrees; (3) veterans; and (4) students currently enrolled in graduate or undergraduate science, technology, engineering, and mathematics (STEM) programs.^{11, 12}
- **Laboratory Enhancement Pilot Program.** This authority provides methods for effective lab management operations. Section 233 of the National Defense Authorization Act for Fiscal Year 2017 established a

⁸Pub. L. No. 110-417, § 219 (2008), as codified at 10 U.S.C. § 2363.

⁹Also, the amount of funds was amended from not more than 3 percent to not less than 2 percent and not more than 4 percent of all funds available to the defense lab in section 212 of the National Defense Authorization Act for Fiscal Year 2017, which was enacted in December 2016. Pub. L. No. 114-328, § 212.

¹⁰10 U.S.C. § 1580 (note) and 10 U.S.C. § 2358a.

¹¹Pub. L. No. 110-417 § 1108 (2008). Pub. L. No. 113-66 § 1107(a)(1) (2013). Pub. L. No. 113-66 § 1107(a)(2) (2013). Pub. L. No. 113-291 § 1105 (2014).

¹²DOD STEM positions include, among others, the following career categories: life sciences, computer sciences and information technology, mathematics and related sciences, and engineering.

pilot program for lab directors to propose alternative and innovative methods that might lead to more effectively managing labs, and authorized lab directors to waive any regulation, restriction, requirement, guidance, policy, procedure, or departmental instruction that would affect implementation of these methods, unless such implementation would be prohibited by a provision of an existing statute or common law.¹³

- **Micro-purchase Authority.** This authority facilitates the purchasing process for labs. The FAR states a preference for government agencies to purchase and pay for micro-purchases of supplies or services using the government-wide commercial purchase card up to and at the micro-purchase threshold, but micro-purchases may be conducted using any of the simplified acquisition methods.¹⁴ This facilitates the ability of lab officials to quickly and easily acquire needed items for their activities and reduce the administrative costs associated with such small purchases. While the FAR micro-purchase was generally \$3,500 during our review, Congress increased it to \$10,000 for activities of the science and technology reinvention labs in Section 217 of the National Defense Authorization Act for Fiscal Year 2017.¹⁵

Major Federal Research Agency Investments

As we found in June 2018, the federal government spends approximately \$137 billion annually government-wide on research and development

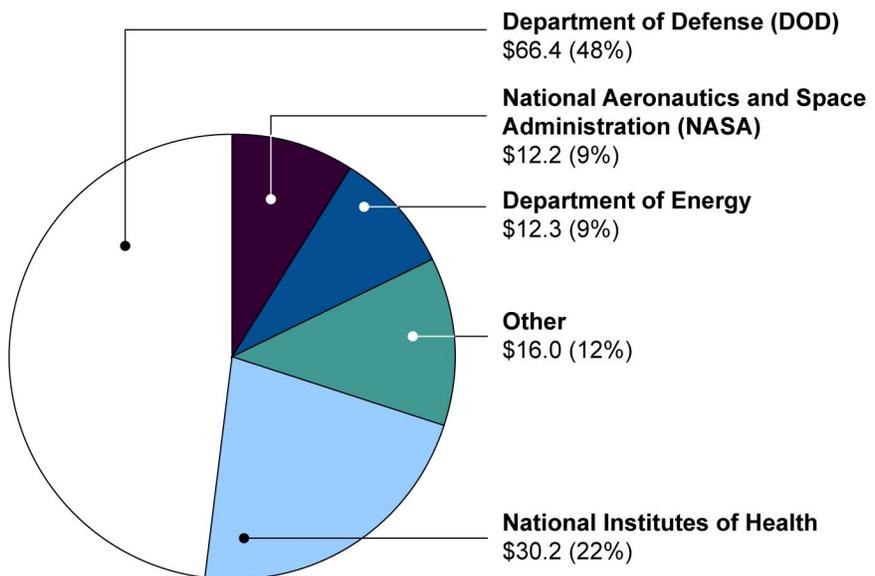
¹³Pub. L. No. 114-328, § 233 (2016) as amended. (10 U.S.C. § 2358 (note)).

¹⁴See FAR § 13.201(b), (c).

¹⁵Pub. L. No. 114-328, § 217 (a) (2016) as amended and codified at 10 U.S.C § 2339. Fiscal year 2017 and 2018 National Defense Authorization Act legislation increased the micro-purchase threshold to \$5,000 and \$10,000 for defense and civilian agencies, respectively. See National Defense Authorization Act for Fiscal Year 2017, Pub. L. No. 114-328, § 821 (2016); National Defense Authorization Act for Fiscal Year 2018, Pub. L. No. 115-91, § 806 (2017) However, neither the defense nor civilian increases have been implemented in the applicable regulations. FAR § 2.101.

(R&D) to help further agencies' missions, including at federal labs.¹⁶ From fiscal years 2015 to 2017, DOD, Energy, and NASA represented three of the top four federal agencies with the highest annual federal R&D spending, accounting for about 66 percent of total federal R&D spending on average, as shown in Figure 3.

Figure 3: DOD, Energy, and NASA Together Accounted for About 66 Percent of Total Federal Research and Development Spending on Average from Fiscal Years 2015 to 2017 (Dollars in Billions)



Source: GAO analysis of National Science Foundation data. | GAO-19-64

While the labs primarily support the agencies that directly fund them, DOD, Energy, and NASA research entities also collaborate extensively to support activities of shared interest. For example, DOD and NASA research centers have collaborated to develop hypersonic vehicle capabilities. Further, Energy's national labs help provide critical national security capabilities for DOD and support NASA's deep space mission

¹⁶GAO, *Federal Research: Additional Actions Needed to Improve Licensing of Patented Laboratory Inventions*, [GAO-18-327](#) (Washington D.C.: June 19, 2018). We use the term spending to refer to agency obligations on R&D, as reported by the National Science Foundation, National Center for Science and Engineering Statistics, *Survey of Federal Funds for Research and Development, FYs 2015–17* (Arlington, VA.: Apr. 5, 2017). Total R&D spending includes all direct, incidental, or related costs, for both intramural and extramural R&D, and does not directly correspond to the R&D spending used to develop, patent, and license inventions at federal labs.

radioisotope requirements. In 2017, Energy reported performing about \$2.6 billion of work per year from fiscal years 2011 through 2015 for other federal agencies and other customers, including DOD.

Defense Labs Have Used Selected Authorities, but Their Use Has Been Offset by Other Military Service Policies and Interests

Most defense labs have used the selected authorities since 2008, but their use has sometimes been limited for a variety of reasons. According to lab directors, this is because of DOD legal and policy restrictions and stakeholder concerns. For example:

- Use of the laboratory initiated research authority was limited by DOD's military construction funding and financial management policies.
- Use of the direct hire authority was limited, in part, by personnel-related delays, security clearance challenges, and military hiring restrictions.
- Use of the laboratory enhancement pilot program was limited by stakeholder uncertainty about how to use this authority effectively.
- Use of the increased micro-purchase authority was limited by stakeholder concerns about the authority's potential effect on small businesses.

Most Defense Labs Have Used the Laboratory Initiated Research Authority, but Less than the Maximum Allowed

We found that most defense labs have used the laboratory initiated research authority. Twenty-three of 31 of respondents to our survey—about 74 percent—reported obligating funds under this authority. However, we found that most labs are not using the full 4 percent of all funds available to each lab, or charging customers the full fixed percentage fee of 4 percent of costs, as allowed by law.¹⁷ Specifically, we found that, as of September 2018:

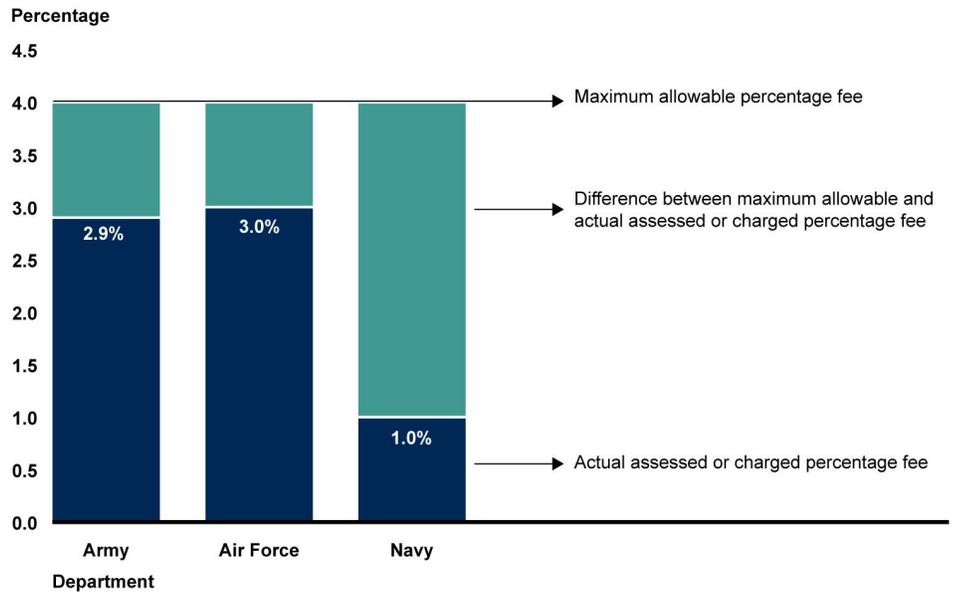
¹⁷Defense lab directors can charge customer activities a fixed percentage fee for activities performed by the lab.

- Navy labs reported charging customers a percentage fee of about 2 percent of costs as of fiscal year 2018. Prior to this, Navy labs only charged a 1 percent fixed fee on these costs. Because Navy labs are working capital funded organizations, they can use payments from customers for goods delivered or services performed.
- Army labs reported using between 2 and 3 percent of all funds available to the lab for projects under the four allowable categories and charging customers a fixed fee of between zero and 3 percent of costs to fund such activities.¹⁸
- Only the Air Force Research Laboratory reported using the full 4 percent of all funds available to the lab. According to agency officials, the lab is using 3 percent of all funds available to the lab and is allowing individual technology directorates the option to use the additional 1 percent of funds available. In fiscal year 2018, three of the lab's nine technology directorates chose to use this additional 1 percent. However, the lab has not charged customers a fixed percentage fee on their costs at all.

As figure 4 shows, in fiscal year 2017, the aggregate fixed percentage fee charged by labs in each of the military departments totaled under the full 4 percent allowed by law for each funding source. Decisions to charge lower percentages are decisions to forego additional potential funding, although agencies have various reasons why this can happen, as we will discuss later.

¹⁸The Army Research Laboratory did not return a completed questionnaire. However, in a previous interview, lab officials stated they were using the full 4 percent of all funds available to the lab for science and technology activities and charging customers a 3 percent fixed fee to fund science and technology activities.

Figure 4: In Fiscal Year 2017, Military Department Labs Did Not Maximize Use of Laboratory Initiated Research Authority

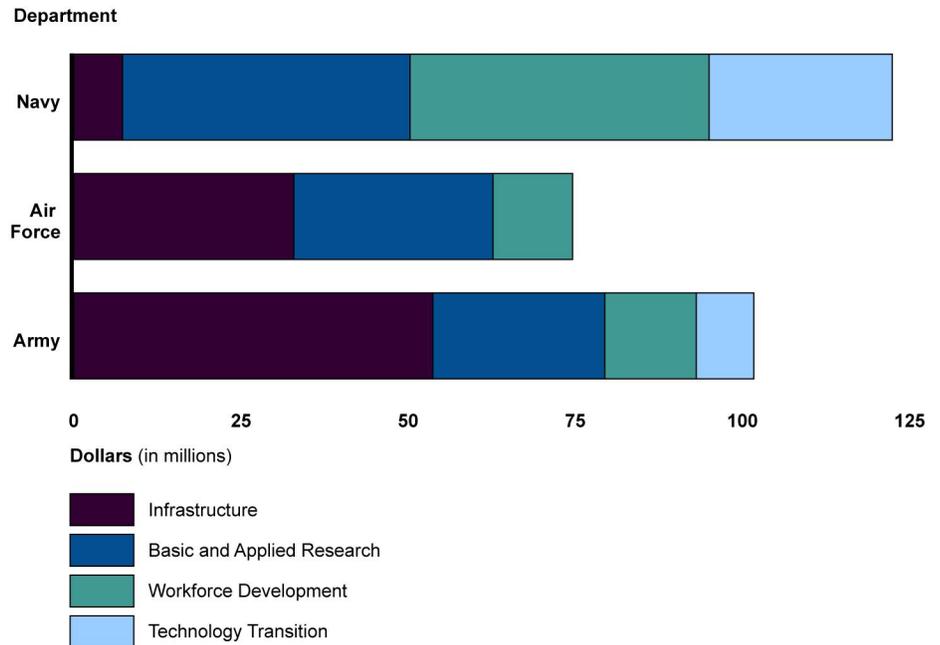


Source: GAO Analysis of Department of Defense data. | GAO-19-64

Note: In December 2016, Congress authorized a maximum allowable fixed percentage fee of 4 percent of costs.

In total, DOD reported that this authority provided almost \$300 million to labs in fiscal year 2017 and funded more than 1,750 projects across the four allowable categories, as Figure 5 illustrates.

Figure 5: Military Department Labs Used Laboratory Initiated Research Authority Funds in Fiscal Year 2017 to Fund Projects across the Four Allowable Project Categories



Source: GAO analysis of Department of Defense data. | GAO-19-64

Note: Infrastructure category includes funds used under the authority for laboratory revitalization, recapitalization, repair, or minor military construction.

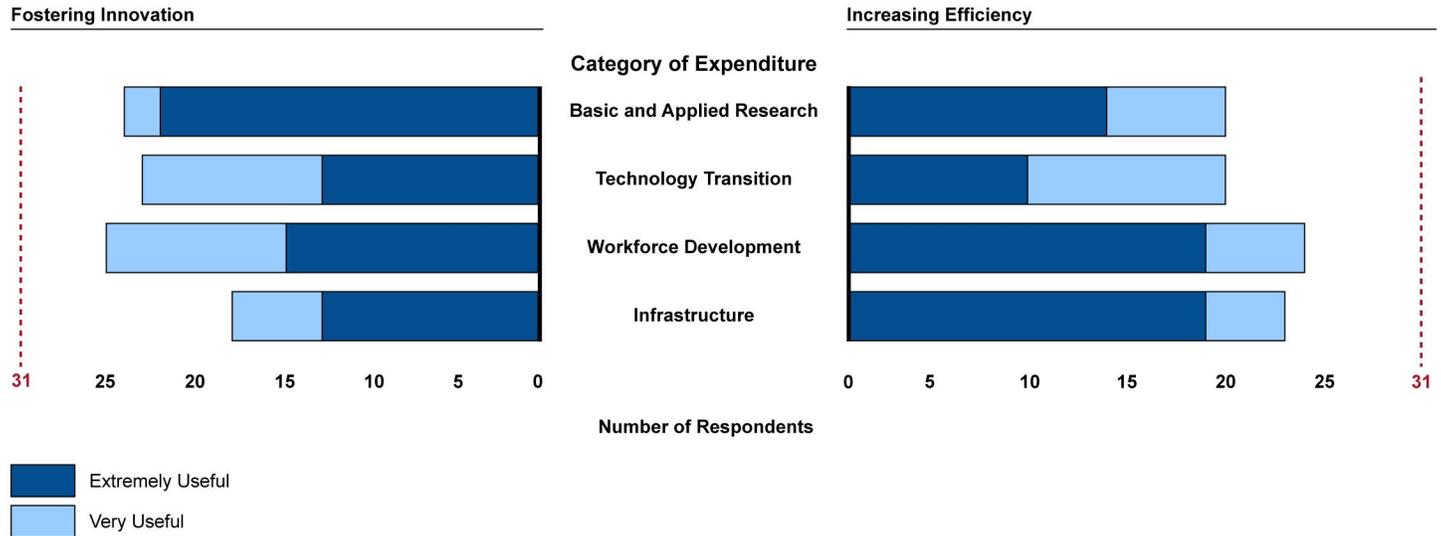
We previously found, in June 2017, that the laboratory initiated research authority provides defense lab directors with limited flexibility to initiate science and technology projects. These projects include those that are not road mapped or tied to defined requirements outside of the normal 2-year budget planning process, and are focused on both near- and long-term needs.¹⁹

For this review, defense lab officials we interviewed stated that the laboratory initiated research authority enables their scientists and researchers to pursue projects not necessarily tied to requirements and provides necessary funds for workforce development and lab infrastructure projects. Further, as shown in Figure 6, lab directors we surveyed generally view the authority as both fostering innovation and

¹⁹[GAO-17-499](#).

increasing efficiency across the four allowable categories on which funds can be used.

Figure 6: Lab Directors GAO Surveyed Generally Reported That Laboratory Initiated Research Authority Is Useful for Fostering Innovation and Increasing Efficiency



Source: GAO analysis of Department of Defense survey responses. | GAO-19-64

Note: GAO received survey responses from 31 DOD lab directors. In addition to the responses above, GAO also received responses that the laboratory initiated research authority was moderately useful, slightly useful, not at all useful, or do not know, for fostering innovation or increasing efficiency. In our survey, we asked lab directors how useful this authority was for: fostering innovation and for increasing efficiency for basic and applied research projects, technology transition, workforce development, and for laboratory revitalization, recapitalization, repair, or minor military construction, which we refer to here as “infrastructure.”

In accordance with the one of the statutory purposes for the use of the funds, lab directors have developed new, innovative technologies using this authority. For example, DOD reported that:

Ballast Water Research Laboratory at Naval Surface Warfare Center, Carderock Division



The Navy invested more than \$700 thousand in laboratory initiated research authority funds to commission a Ballast Water Research Lab at Naval Surface Warfare Center, Carderock Division. Through the use of this new facility, engineers will be able to study ways to treat ballast water to prevent introduction of non-native aquatic species into a new environment that can be disastrous for the marine life that already inhabit that environment, and ensure that the Navy is able to meet various port regulations around the world for its ships.

Source: GAO analysis of Navy documentation; photo – (U.S. Navy photo by Monica McCoy/Released). I GAO-19-64

- In fiscal year 2017, the Naval Surface Warfare Center, Crane Division, developed and fielded a solution to an urgent requirement for defeating small unmanned aerial vehicles that attack Navy assets or surveil naval activities. The center delivered this technology to the warfighter in May 2017 just 7 weeks after the Navy submitted the requirement.
- The Army Research Laboratory used the authority to fund a project that eventually developed a material that could increase the speed and lower the power needs of future generations of computer chips, thereby supporting Army networks.
- The Air Force Research Laboratory invested funds in fiscal year 2017 to renovate an existing facility to provide high performance computing capability to aid the rapid development of “game-changing” technologies and weapon systems.

Officials at the Army’s Space and Missile Defense Command Technical Center noted they used the laboratory initiated research authority for the first time in fiscal year 2018 because the current executive director, who assumed the position in 2017, prioritized implementing this authority. Most of the Center’s planned investments are focused on workforce development and laboratory infrastructure projects; officials cited a high energy laser technology lab as one of the projects being supported by the revitalization, recapitalization, or minor military construction portion of this authority.

Although the majority of defense labs reported using the laboratory initiated research authority, interviews we conducted throughout our review, along with other DOD reports, identified certain obstacles that have, at times, impeded wider usage.

- **DOD-wide military construction funding restrictions.** DOD restrictions limit the amount of laboratory initiated research authority funds that labs can spend on lab infrastructure. DOD’s limit is \$6 million for the revitalization and recapitalization projects that can be funded under the laboratory initiated research authority. Lab officials stated that this amount is often insufficient to construct advanced lab facilities. Air Force Research Laboratory officials indicated that it is nearly impossible to construct lab facilities for less than \$6 million. Officials at the Army’s Aviation and Missile Research, Development and Engineering Center echoed this sentiment and noted that they have primarily used funds to renovate existing buildings rather than fund new lab facility construction. In January 2017, the Defense Science Board identified lab infrastructure challenges, including that

the average age of research and development facilities was nearly 50 years. Further, the Board reported that the labs are usually not successful in competing against broader service needs for military construction funds.

- **Air Force does not charge customers a fixed percentage fee of costs.** The Air Force Research Laboratory reported that it is not charging customers the allowable fixed percentage fee of costs to fund science and technology activities because it does not have a mechanism in place to do so. Air Force Research Laboratory officials estimated the lab would collect approximately \$3 million a year if the lab charged customer activities the maximum allowable fee (4 percent). Air Force financial management officials stated that the service's accounting system does not currently have an automated capability to transfer the allowable percentage fee of costs to a central account at the Air Force Research Laboratory. This lack of capability, officials noted, creates a significant administrative burden for charging these fees. The officials stated that they have not yet estimated the cost to add an automated capability.

Although it is possible for the Air Force Research Laboratory to charge customer work orders manually—outside of the Air Force's accounting system—officials with the Office of the Assistant Secretary of the Air Force for Financial Management and Comptroller perceive that the resources (time and people) required to manage such a process would be cost prohibitive. However, according to these officials, the Air Force has not assessed the costs required to improve the accounting system to do so, nor has it identified the potential benefits any improvements would provide. Federal internal control standards state that changes in condition affecting an entity and its environment often require changes to the entity's internal control system, as existing controls may not be effective for meeting objectives (or addressing risks) under changed conditions. Further, these standards state that any internal control deficiencies require further evaluation and remediation by management.²⁰ By not assessing the potential costs and benefits related to the options for collecting these allowable fees, the Air Force could be missing out on a potential source of funding to support its needs.

²⁰See principles 9.04 and 17.05 within GAO, *Standards for Internal Control in the Federal Government*, [GAO-14-704G](#) (Washington, D.C.: September 2014).

- **DOD lacks clear guidance on how the Navy should use the initiated research authority for some infrastructure investments within the Capital Investment Program.** In our review of DOD documentation, we found that, among the military departments, Navy labs funded recapitalization and revitalization projects using the laboratory initiated research authority the least. As recently as early 2017, a DOD-commissioned study found that defense labs face substantial infrastructure deficiencies that it has not yet identified funding to address.²¹ In fiscal year 2017, Navy labs invested \$7.3 million in lab recapitalization projects, compared to \$32.9 million and \$53.7 million at the Air Force and Army, respectively. Navy lab officials told us that their ability to fund lab recapitalization and revitalization projects using funds available under the laboratory initiated research authority is limited because they have not been provided with clear guidance as to whether and how to use the laboratory initiated research authority within the Capital Investment Program of the Navy Working Capital Fund.

Some Navy lab officials stated that they have found ways to use the initiated research authority for certain infrastructure investments. These officials stated that they used authority outside of the Capital Investment Program of the Navy Working Capital Fund, for instance, for projects below applicable thresholds because using the authority within the Program creates a bureaucratic and financial burden for them. For example, officials at two separate warfare centers—Naval Surface Warfare Center, Crane Division, and the Naval Air Warfare Center, Aircraft Division, noted that they did not expend funds in either fiscal year 2016 or fiscal year 2017 for recapitalization and revitalization projects. Both cited the Capital Investment Program as a significant barrier to their desired use of the laboratory initiated research authority.

Officials from the Office of Budget, within the Office of the Assistant Secretary of the Navy for Financial Management and Comptroller agreed that, to date, clarifying guidance on the use of the laboratory initiated research authority within the Capital Investment Program has not been issued, effectively limiting the extent to which the labs can use it for infrastructure needs. According to these officials, the Office of the Secretary of Defense (OSD) Comptroller—in coordination with

²¹Defense Science Board, *Defense Research Enterprise Assessment*, (Washington, D.C.: Jan. 25, 2017).

the Office of Financial Policy and Systems within the Office of the Assistant Secretary of the Navy for Financial Management and Comptroller—is responsible for developing the clarifying guidance their office has sought. This persistent lack of guidance on whether or how Navy labs should use the laboratory initiated research authority within the context of the Capital Investment Program presents an opportunity cost. Namely, the Navy’s labs have missed out on, and continue to miss, opportunities to invest in needed improvements to its aging lab infrastructure.

- **The Army requires its laboratories to apply similar percentages to what is refers to as “Army direct appropriations” and “customer funds.”** The Army requires that the percentage fee applied to direct appropriations not vary from the percentage fee applied to customer funds by more than 1 percent. The Army implemented this policy to maximize the laboratory initiated research authority’s effect on its 17 laboratories. However, the Office of the USD(R&E) reported in March 2018 that the policy was having a significant limiting effect on the breadth and scope of activities executed under this authority.²² Similarly, we found that the policy may, in practice, create a disincentive for Army lab directors to use the authority. In their responses to our survey, Army lab directors, representing key capability areas, acknowledged their concern about the percentage fee they assessed on customer funds affecting their ability to increase or maintain their customer bases. Further, some Army lab directors reported assessing a lower percentage fee on customer funds than allowed, which could help retain customers that might otherwise be driven away with higher assessed fees to carry out activities. As a result, these labs generally are setting a lower percentage fee on their directly appropriated funds, thereby lowering the overall laboratory initiated research funding available to them. Nonetheless, the Army has not assessed its policy to determine whether changes are needed to eliminate these disincentives. Continuing to operate without such an assessment could result in Army labs using the laboratory initiated research authority to fund fewer self-initiated projects—with the downstream effect that fewer new technologies for warfighters are available.

²²Office of the Under Secretary of Defense for Research and Engineering, *Report to Congress on the Mechanisms to Provide Funds for Defense Laboratories for Research and Development of Technologies for Military Missions*, March 2018.

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- **The Navy applies a consistent fixed percentage fee of costs across its labs.** Within the Navy, senior leadership has set the fixed percentage fee of costs the labs charge on customer funds at 2 percent. A senior Navy science and technology official stated that Navy leadership set a uniform fixed percentage fee to charge to customer activities across the Navy lab enterprise, in part, to ensure the labs were not inadvertently competing against one another for customer funds. For example, without a uniform rate, a Navy warfare center could offer a lower fee to entice a customer to use it rather than another center. The use of a fixed percentage fee facilitates program offices selecting warfare centers on the basis of best available match in capabilities. On the other hand, the Navy's fixed 2 percent fee of costs does limit—by half, as compared to the maximum 4 percent allowable—the amount of fees that Navy labs can collect. Consequently, several Navy lab directors told us that they would like to have the ability to increase the fixed percentage fee of costs above the Navy's 2 percent to provide their labs with additional resources they said they need for innovation-related investments.

DOD Labs Have Used Direct Hire Authorities to Hire Qualified Candidates for Key Scientific Positions but Experienced Delays

Among the lab directors that responded to our survey, 30 of 31 replied that their lab had used at least one of the four types of direct hire authorities previously discussed since fiscal year 2014.²³ Officials view direct hire authority as allowing the labs to compete with private industry for qualified applicants. Lab directors reported they generally believe that each type of direct hire is extremely or very useful for fostering innovation and increasing efficiency, as shown in Figure 7.

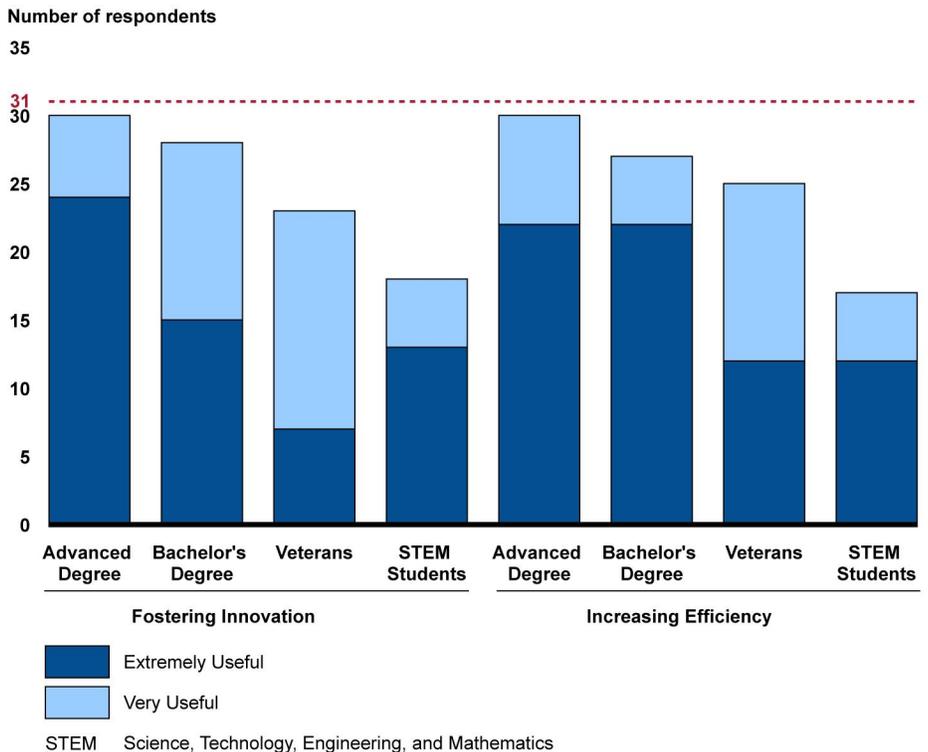
Selected Officials' Testimony on the Value of Direct Hire Authority:

The U.S. Army Engineer Research and Development Center "was able to meet this important goal [of annually hiring more than 160 new researchers] in large part because of its direct hiring authorities, which save time, effort, and costs, and allow the organization to more effectively hire the best and brightest minds available." – Dr. Jeffrey P. Holland, Past Director, U.S. Army Engineer Research and Development Center, in testimony before the Senate Committee on Armed Services (Emerging Threats and Capabilities Subcommittee), May 3, 2017.

"The Air Force's ability to recruit, retain, and develop the STEM workforce is vital toward building the future Air Force; Congress has been greatly supportive of these efforts...the addition of direct hire for candidates has been extremely useful in hiring qualified scientists and engineers in less than half the time of traditional hiring methods." – Jeffrey Stanley, Air Force Deputy Assistant Secretary—Science, Technology and Engineering in testimony before the House Committee on Armed Services (Emerging Threats and Capabilities Subcommittee), March 14, 2018.

Source: Congressional Testimony. | GAO-19-64

Figure 7: Lab Directors GAO Surveyed Responded That Direct Hire Authorities Are Useful for Fostering Innovation and Increasing Efficiency



Source: GAO analysis of Department of Defense survey responses. | GAO-19-64

²³10 U.S.C. 1580 note and 10 U.S.C. 2358a.

Note: GAO received survey responses from 31 DOD lab directors. In addition to the responses above, GAO also received responses that the direct hire authority was moderately useful, slightly useful, not at all useful, or do not know, for fostering innovation or increasing efficiency.

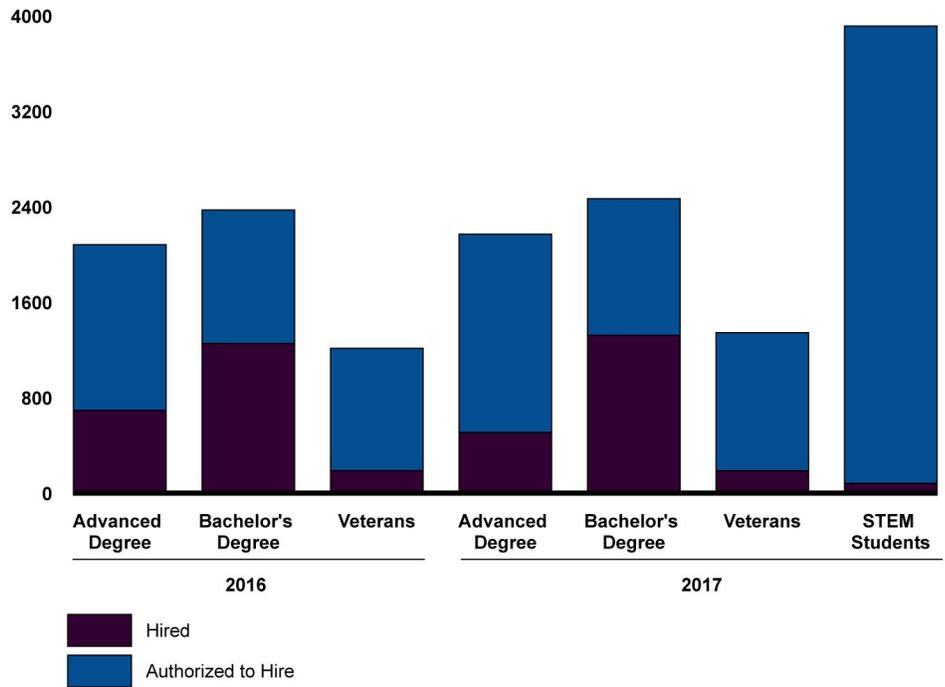
In May 2018, we found that for fiscal years 2015 through 2017, the defense labs used direct hire authorities more often than any other category of hiring authorities when hiring STEM personnel. We also previously found that the defense labs' median time to hire in fiscal year 2017, when using the competitive hiring process, was approximately twice as long as when using direct hire authorities—162.5 days compared to 80.0 days.²⁴

However, in calendar years 2016 and 2017, our analysis of DOD data indicated the defense labs hired substantially fewer candidates than they were authorized to hire using direct hire authorities, as shown in Figure 8. For example, the Navy labs hired 261 candidates with an advanced degree, or approximately 19 percent, of their authorization in calendar year 2017. Similarly, the Air Force Research Laboratory hired 54 candidates, or 25 percent, with a Bachelor's degree in calendar year 2017, using the direct hire authority for candidates with a Bachelor's degree.

²⁴GAO, *DOD Personnel: Further Actions Needed to Strengthen Oversight and Coordination of Defense Labs' Hiring Efforts*, [GAO-18-417](#) (Washington, D.C.: May 30, 2018).

Figure 8: Military Departments Did Not Use Direct Hire Authorities to the Maximum Extent Allowable in Calendar Years 2016 or 2017

Total Number of Candidates Authorized to Hire



STEM Science, Technology, Engineering, and Mathematics

Source: GAO analysis of Department of Defense data. | GAO-19-64

Note: DOD's use of direct hire authority for current and recent undergraduate and graduate STEM students was implemented by DOD in June 2017.

We found a number of reasons why the defense labs have not hired the number of candidates they were authorized to hire. Among these, lab directors cited:

- The requirement to use external, military service human resources offices to process lab personnel actions proved time consuming.** Officials with the Army's Aviation and Missile Research, Development and Engineering Center noted that while direct hire authorities allow them to make an initial employment offer, this only begins the hiring process, most of which is external to the lab. For example, officials indicated that under existing personnel policies, the lab cannot submit paperwork for current STEM students to their local personnel office until the candidate is within 60 days of graduating. Officials noted a firm employment offer cannot be made until the candidate has at least an interim security clearance, which can take at

least a month to process and will not be initiated until the candidate has graduated. According to officials, they have lost several candidates in the past year because of this hiring process.

A senior official at the Navy's Space and Naval Warfare Systems Center Atlantic cited the Navy's human resources and personnel process as a barrier to using direct hire authority. Specifically, this official noted how direct hire authority is intended to allow labs to move quickly in making personnel decisions, but that the overall civilian human resources process is not designed to be agile. As a result, according to this official, the delay and time it takes to get actions processed through the Navy's civilian human resources office has caused a large number of candidates to decline job offers. We previously found in May 2018 that employees at the human resources offices may not have an understanding of the lab's unique hiring authorities, and that this lack of knowledge could create delays. We identified the need for DOD to better position the Defense Laboratories Office to provide effective oversight of laboratory hiring. Specifically, we recommended that DOD establish and document time frames for its coordination process across relevant offices. DOD agreed with our recommendations but has not yet implemented them.²⁵

- **Security clearance processing for new lab employees is regularly delayed.** Lab officials stated that the length of time it takes for new hire candidates to obtain the necessary clearances to perform research continues to grow. Naval Research Laboratory officials stated there have been instances where new hires left the lab for other opportunities due to delays with their security clearances. Senior Navy science and technology officials described the security clearance process as the "Achilles' heel" of the hiring process—especially at the Navy's warfare centers—noting that it takes too long for new hires to obtain a clearance. This issue is not unique to the DOD lab environment. We added the government-wide personnel security clearance process to our High Risk List in 2018, based on our prior work that identified, among other issues, a significant backlog of

²⁵[GAO-18-417](#).

background investigations and delays in the timely processing of security clearances.²⁶

- **Military service-imposed hiring restrictions on labs offset the use and benefits of direct hire authority.** A senior Army science and technology official stated a specific command-wide hiring freeze—which restricts the centers to hiring one candidate for every six employees that leave—caused Army research centers to not fully utilize direct hire authority.²⁷ One lab director reported that while direct hire authority has been extremely helpful in his ability to recruit top talent in a timely manner to compete with private industry, hiring restrictions have limited this ability. In May 2018, we found that across the military departments, the defense labs identified the government-wide hiring freeze as a challenge with using expedited hiring authorities—including direct hire. Further, we found that hiring officials and supervisors stated that they had lost candidates they were in the process of hiring because the candidates had accepted other offers due to the delays created by the hiring freeze.²⁸
- **Use of direct hire authority for current undergraduate and graduate STEM students remains in early implementation.** Although this authority was initially enacted by Congress as part of the Carl Levin and Howard P. “Buck” McKeon National Defense Authorization Act for Fiscal Year 2015, it was amended in subsequent legislation and it was implemented by DOD in June 2017.²⁹ As a

²⁶GAO, *Personnel Security Clearances: Additional Actions Needed to Ensure Quality, Address Timeliness, and Reduce Investigation Backlog*, GAO-18-29 (Washington, D.C.: Dec. 12, 2017); and *Personnel Security Clearances: Plans Needed to Fully Implement and Oversee Continuous Evaluation of Clearance Holders*, GAO-18-117 (Washington, D.C.: Nov. 21, 2017).

²⁷In June 2018, the Army Materiel Command lifted the 1:6 hiring ratio it had imposed on its Research, Development and Engineering Centers, along with the Army Research Laboratory. The Army Materiel Command then imposed new hiring restrictions, which range from a 1:2 ratio at the Army Research Laboratory to a 1:5 ratio at the Armament Research, Development and Engineering Center and the Edgewood Chemical and Biological Center.

²⁸GAO-18-417.

²⁹82 Fed. Reg. 123, 29280, June 28, 2017, amended existing STRL Personnel Management Demonstration Project Programs. Direct hire for temporary or term undergraduate and graduate STEM students was initially authorized at the defense labs as part of the Carl Levin and Howard P. “Buck” McKeon National Defense Authorization Act for Fiscal Year 2015. The National Defense Authorization Act for Fiscal Year 2016 authorized the lab directors to noncompetitively convert these students to permanent appointments within the defense labs.

result, the defense labs hired significantly fewer undergraduate and graduate STEM students than they were authorized to in calendar year 2017. For example, the Air Force Research Laboratory was authorized to hire 300 STEM students using this direct hire authority in calendar year 2017, but only hired 4.

Stakeholder Concerns Have Limited Implementation of Laboratory Enhancement Pilot Programs

Although participation in the laboratory enhancement pilot program is open to the DOD labs—and 19 of the 31 lab directors, or 61 percent, that responded to our survey reported they were participating—to date, only the Navy has formally established a pilot program for its labs.³⁰ The Army and Air Force have not yet used this relatively new authority. A senior Navy science and technology official told us the Navy took important steps to facilitate the implementation of that service’s pilot program. According to the Navy official:

- The Office of the Deputy Assistant Secretary of the Navy for Research, Development, Test and Evaluation led the effort across the Navy labs, compiling—from each lab’s submission—a single list of proposals to forward to Navy leadership that would apply to all participating Navy labs.
- The Navy pursued a three-phased approach with its pilot program, with Phase 1 primarily focused on contracting and acquisition policy-related matters. Senior Navy research and development officials perceived these matters as being the easiest from which to obtain buy-in from Navy policy officials and attorneys, as well as Navy leadership. Phase 2 will include proposals related to Information Technology systems for research and development networks, while Phase 3 will most likely address personnel issues.
- Navy research and development officials deferred proposals—including information technology network enhancements—that might require extensive discussions with policy officials and attorneys stakeholders across the Navy. These proposals were pushed back to

³⁰Participation in the laboratory enhancement pilot program consists of eligible centers within each military department. For the purposes of this report, if a lab responded that they were participating in the pilot program, the lab either has or plans to submit proposals for its pilot program to its service acquisition executive. An established pilot program is defined as the lab’s pilot program proposals have been approved and are being implemented by the lab.

allow time for those stakeholders to see how the pilot program was being implemented and executed by the labs.

None of the Army and Air Force labs has yet established a laboratory enhancement pilot program. Consistent with Army policy, the Medical Research and Materiel Command and the Space and Missile Defense Command Technical Center submitted proposals; however, they have yet to establish a pilot program.³¹ The Army's Research, Development and Engineering Command, with input from its subordinate labs and engineering centers, developed a list of lab enhancement proposals but, as of September 2018, had yet to formally submit these final proposals to Army leadership for approval. These include initiatives in business operations, contracting, finance, information technology, and personnel management. A senior Army science and technology acknowledged that organizations across the military department have concerns about providing the labs with too much autonomy to use this new authority.

Air Force Research Laboratory officials said they previously submitted a list of approximately 30 proposals to the Defense Laboratories Office in September 2017, but ultimately pulled back those requests because of stakeholder concerns within the Air Force. Specifically, officials with the Office of the Deputy Assistant Secretary of the Air Force for Science, Technology, and Engineering stated that the Air Force Materiel Command, to which the lab is a subordinate organization, had not seen the proposals before they were submitted. In addition, these officials identified concerns about how various stakeholders throughout the Air Force—such as those from financial management and personnel—would react to these proposals. These proposals could potentially sidestep the stakeholders' oversight function of related lab activities. A senior Air Force Research Laboratory official stated that the lab re-submitted its proposals to the Air Force Materiel Command and that Air Force leadership was still reviewing them at the time of this report.

³¹The Army's Laboratory Enhancement policy requires that a lab submit an application to participate, which includes the proposals it seeks to implement. If approved, the participating lab must then submit the policies or regulations it wants waived in order to implement those proposals. The Medical Research and Materiel Command had one proposal disapproved because it sought to waive an Army policy that has not yet been finalized, while the Space and Missile Defense Command Technical Center has not yet submitted the policies or regulations it seeks to waive.

Defense Labs Have Widely Implemented Micro-Purchase Authority

Twenty-six of 31 labs directors—84 percent—reported having used the \$10,000 micro-purchase threshold authority granted by Congress in 2016. However, we found that contracting and small business management officials' concerns with this authority have created implementation challenges at some defense labs. For instance, a senior Navy official indicated that multiple stakeholders from across the Navy—including its Office of Small Business Programs—raised concerns about the authority's potential impact on small businesses as micro-purchasing allows defense labs to bypass small business set asides. Several labs reported similar stakeholder concerns that prevented implementation of the micro-purchase threshold increase.

At the same time, however, lab officials we interviewed expressed the view that the increased threshold will be beneficial, consistent with their opinions about the laboratory enhancement pilot program. For example, officials at the Naval Research Laboratory stated that increasing the threshold to \$10,000 allows their scientists and engineers to directly purchase necessary equipment and materials through simplified procedures. They identified examples of projects that had been delayed by as much as several months because scientists and engineers used other than simplified acquisition procedures to purchase a relatively inexpensive piece of equipment, such as a specialized microscope, because the cost was above the previous threshold of \$3,500.

Similarly, the Army's Armament Research, Development and Engineering Center reported that the micro-purchase threshold increase enables the lab to use simplified acquisition procedures for more items. As a result, they noted that the new authority increases efficiency by reducing contracting time and cost for those additional items. The Navy's Space and Naval Warfare Systems Center Atlantic similarly reported that requirements, which were previously procured using other than simplified acquisition procedures, took up to 60 to 90 days to procure, while it took as little as 3 to 4 days under this new authority, which enabled its scientists and engineers to purchase materials needed for critical, time sensitive projects. However, lab officials acknowledged that the \$10,000 micro-purchase threshold authority—like the laboratory enhancement pilot program—is too new to fully understand how it will increase efficiency and foster innovation over the long term.

DOD Gains Scientific Expertise from Research Centers Governed through Noncompetitive Contracts

DOD sponsors several research centers, which are governed through noncompetitive agreements, including contracts. These centers provide the department with access to scientific experts employed by universities and other non-profit organizations. Scientists employed by these external to DOD research centers—specifically, three lab FFRDCs and 13 UARCs—execute DOD-funded science and technology development projects in emerging technical areas. DOD staff oversee these centers using routine oversight of funded research tasks and comprehensive reviews, which help DOD determine whether the centers' funding should continue. DOD and research center officials told us that their ability to authorize work at the FFRDCs that DOD sponsors is limited by legislative restrictions on the staffing levels at these centers, as well as by infrastructure modernization challenges they face.

External DOD Research Centers Are Funded by the Government Established under Noncompetitive Procedures

DOD sponsors three research and development FFRDC labs that were established under noncompetitive procedures.³² Two of the three lab FFRDCs are operated by universities and one is operated by a nonprofit company. DOD also has contracts with 13 UARCs that fulfill a similar scientific role as the lab FFRDCs, while also differing from them in other respects. These differences are described in more detail in table 1.

Table 1: DOD-funded Research Center Governance Models

Lab Type	Operator	Oversight Authorities	Some Relevant Authorities	Operating Characteristics
Research & Development Lab	1 non-profit research institute	<ul style="list-style-type: none"> Primary sponsors at Office of the Secretary of 	<ul style="list-style-type: none"> 10 U.S.C. § 2367 and Federal Acquisition 	<ul style="list-style-type: none"> FFRDCs are not allowed to compete with industry in

³²DOD entities sponsor 10 FFRDCs in total, which are managed by various military departments or divisions of DOD. In addition to the 3 research and development labs, these FFRDCs include 2 systems engineering and integration centers and 5 study and analysis centers.

Lab Type	Operator	Oversight Authorities	Some Relevant Authorities	Operating Characteristics
Federally Funded Research and Development Centers (FFRDC)	2 university contractors	<ul style="list-style-type: none"> Defense with assistance of U.S. Air Force for two FFRDCs; National Security Agency sponsors one other. Primary sponsors conduct periodic reviews of sponsoring agreements that will not exceed 5 years to decide if the sponsors will renew the agreement. Active oversight of FFRDC and its work program by primary sponsors. 	<ul style="list-style-type: none"> Regulation (FAR) § 35.017; DOD Instruction 5000.77; Defense Federal Acquisition Regulation Supplement (DFARS) § 235.017. 10 U.S.C. § 2304 (c)(3)(B) and FAR § 6.302-3(a)(2)(ii). 	<ul style="list-style-type: none"> response to a Request for Proposals other than for the operation of an FFRDC. FFRDCs operate free from conflicts of interest. Annual ceilings set by Congress restrict the amount of work FFRDCs can perform for DOD. Primary sponsors must approve all work before it is placed on contract.
DOD University Affiliated Research Centers (UARC)	13 university contractors	<ul style="list-style-type: none"> Primary sponsors at Army, Navy and other DOD offices. Undergo primary sponsors' comprehensive reviews at least every 5 years to decide if centers will continue with DOD. Policy and contractual oversight by primary sponsors. 	<ul style="list-style-type: none"> 10 U.S.C. § 2304(c)(3)(B) and FAR § 6.302-3(a)(2)(ii). 	<ul style="list-style-type: none"> Similar to FFRDCs, they are established to provide or maintain essential engineering, research, or development capabilities through a long term, strategic relationship with DOD, free from conflicts of interest; they have broad access to information including proprietary data.

Source: GAO analysis of DOD and other federal documentation. | GAO-19-64

DOD's contractor-operated research centers received about \$1.3 billion annually in DOD funding in fiscal year 2016 and fiscal year 2017, according to DOD data. The two largest research and development FFRDCs, the Lincoln Laboratory and the Software Engineering Institute, received about 67 percent of total research center funding from DOD in 2017. UARCs received an average of \$27 million in DOD funding, which was a 15 percent decrease from 2016. Research centers may also receive work and funding from other federal departments and private companies after obtaining DOD sponsor approval. Appendix II provides an overview of DOD FFRDC and UARC funding in fiscal years 2016 and 2017.

DOD Sponsorship and Contract Awards: We reported in 2014 that FFRDCs in the federal government are defined through the sponsoring agreement between the agency and the contractor retained to operate the FFRDC. A written agreement of sponsorship between the government and the FFRDC must be prepared when the FFRDC is established, which

may be included in a contract between the government and the FFRDC, or in another legal instrument under which an FFRDC accomplishes effort, or it may be in a separate written agreement.³³ Historically, DOD sponsors retain contractors for many years or decades as FFRDC operators. We found that research centers undertake DOD-sponsored projects and, in some limited instances, scientific projects initiated by centers that are overseen by DOD staff. Individual sponsors enter into noncompetitive contracts with FFRDCs and UARCs. DOD uses noncompetitive contracts to establish or maintain an essential engineering, research, or development capability to be provided by an educational or other nonprofit institution or a federally funded research and development center.³⁴

Scientific Project Funding: We found that project sponsors provide funding to existing contracts. For example, the government issues orders for requirements under Lincoln Laboratory's indefinite delivery indefinite quantity base contract as funding sponsors approve new projects. Individual project sponsors, along with the primary sponsor, oversee how project funds are spent by the centers.³⁵ Project sponsors decide whether they will continue to work with these entities based on perceived performance success. This effectively provides an incentive for FFRDCs and UARCS to perform successfully. This work and review cycle is described in Figure 9 below.

³³GAO, *Federally Funded Research Centers: Agency Reviews of Employee Compensation and Center Performance*, [GAO-14-593](#) (Washington, D.C.: Aug. 11, 2014).

³⁴10 USC § 2304(c)(3)(B) as implemented by FAR § 6.302-3(a)(2)(ii).

³⁵An indefinite delivery indefinite-quantity contract provides for an indefinite quantity, within stated limits, of supplies or services during a fixed period. The government places orders for individual requirements. FAR 16.504(a).

Figure 9: DOD Contractor-operated Research Center Work and Review Cycle

Establish Center Relationship and Define Core Competencies

Primary Sponsor identifies the need for research center work.

Center leadership, in coordination with government sponsors, defines general scientific core competencies, defines center roles and responsibilities in sponsoring agreement.

Establish Center Work Program

Awards noncompetitive contract to support primary sponsor objectives

Establishes work review and management structure to administer the FFRDC

Implement

Centers and sponsors coordinate projects.

Center and primary sponsor ensure work complies with annual work hours limit and sponsoring agreement.

Implement

Center executes scientific work; overseen by project sponsor and primary sponsor staff.

Centers' scientific teams collaborate with scientists at other laboratories to leverage their expertise.

Performance Assessment

Primary sponsor, with assistance of project sponsors and contracting officials, review center performance in written assessments.

Comprehensive reviews are required at least every 5 years.

Decide to Extend or End Relationship with Center

Project sponsors decide if they want to continue funding projects at specific research centers, based on degree of perceived success.

Primary sponsor assesses whether DOD continues to need the center's services or if it should cease.

Source: GAO analysis of Department of Defense (DOD), federally funded research and development center, and university affiliated research center documents. | GAO-19-64

FFRDCs and UARCs also partner with DOD government-operated labs to plan and execute technology development projects. For example, according to Navy officials, Naval Surface Warfare Center, Carderock Division collaborated with Navy-sponsored UARCs, such as Penn State's

Applied Research Laboratory, to help develop Navy submarine propeller and propulsion designs.

Self-initiated Projects: Research center officials said that DOD provides some research centers with limited funds to self-initiate innovative projects. This funding helps the centers ensure that development projects are not limited to just satisfying near-term DOD requirements. Instead, future generations of DOD technologies can be funded. For example, officials at Johns Hopkins University Applied Physics Laboratory proactively conducted work on advanced naval defense technologies in response to similar technology development in adversary countries. Although Navy sponsors did not fund this initial work, they subsequently provided funding in this area after Hopkins' research identified a risk reduction strategy for the Navy, according to the Johns Hopkins officials. This allowed the UARC to move relatively quickly on a new science and technology project idea.

Research Centers Provide DOD with Access to Scientific Expertise

DOD uses 13 UARCs and three lab FFRDCs to obtain direct access to scientific expertise in emerging technical areas, supplementing research conducted at DOD's government-owned and operated labs.³⁶ These research centers provide DOD with additional scientific capabilities and the ability to expand quickly into new technical fields.

Hiring Scientific Personnel: Although FFRDCs are largely federally funded, they are generally operated, managed, and administered by either a university or consortium of universities, other not-for-profit or nonprofit organization, or an industrial firm, as an autonomous organization or as an identifiable separate operating unit of a parent organization. The contractor operating the FFRDC exercises primary control over its FFRDC's business concerns, such as personnel policies and compensation.³⁷ DOD-funded research centers have flexibility in hiring scientists that leverage a parent institution's expertise in emerging scientific fields. For example, leadership officials at the Army Institute for Soldier Nanotechnologies UARC at MIT and the Software Engineering

³⁶At the time of our review, DOD was in the process of establishing a fourteenth university affiliated research center with the University of Alaska.

³⁷[GAO-14-593](#).

Institute FFRDC at Carnegie-Melon University noted that projects they have conducted for DOD have benefitted from university experts in fields such as dark matter physics and artificial intelligence.

**Massachusetts Institute of Technology
Lincoln Laboratory**



The Lincoln Laboratory—managed by the Massachusetts Institute of Technology—is a federally funded research center sponsored by the Department of Defense (DOD). Established in 1951, the lab researches and develops technologies to support national security needs. This laboratory has provided technical innovations in radar, aerospace technology, and communications, among other things, for DOD.

Source: © 2018 MIT Lincoln Laboratory. | GAO-19-64

Personnel Compensation: Research center officials we spoke with noted that their workforce policies permit them to flexibly hire, fire, and compensate staff as needed. Although employee salaries are established separately from the government schedule, they are approved by the government. Further, officials noted that university centers typically offer salaries in line with the labor market, but do not attempt to compete on a salary basis with relatively high, unaffordable private sector company salaries. Instead, they compete on the basis of other factors, such as offering scientists the opportunity to work for a prestigious university conducting science and technology research.

Research Center Infrastructure: As with personnel matters, research centers have discretion to manage infrastructure in accordance with the policies and procedures of their parent institutions. While one center, Lincoln Laboratory, is located on government property, others primarily reside on property owned or leased by their parent institutions. According to agency officials, DOD contributes funding for the use and repair of these facilities through their contracts with research centers. Officials noted that Lincoln Laboratory uses military construction funding to pay for new buildings as it is located on government property.

Trusted Advisor Role: FFRDCs and UARCs function as trusted advisors for the government and operate in the public interest with objectivity and independence. FFRDCs are independent, private-sector, non-profit organization units required to be free from personal or organizational conflicts of interest, as the FFRDCs answer to the government customer. As a result, DOD's lab FFRDCs perform tasks that are closely associated with the performance of inherently governmental functions and have access to sensitive and proprietary data.

DOD-Sponsored Research Centers Are Limited in the Amount of Work They Can Perform for DOD, According to Research Center Officials

Research center officials noted challenges limiting their work providing scientific expertise to DOD. FFRDCs are also limited in executing infrastructure investments.

Limitation on Available Work Hours: DOD FFRDCs are limited by an annual ceiling set by Congress on the amount of staff years of technical effort (STE) that may be funded for defense FFRDCs.³⁸ We previously found in October 2008 these limits were imposed in response to concerns that DOD was inefficiently using its FFRDCs. We found that the STE workload limitation aimed to ensure that FFRDC work was appropriate and limited resources were being used for DOD's highest priorities.³⁹ As a result, Software Engineering Institute officials said they decline many DOD programs' requests for assistance due to the annual work hour limitation. Further, officials at the Office of the Secretary of Defense's Studies and FFRDC Management Office reported that this limit significantly constrains the use of DOD's FFRDCs and that DOD customer demand for their services is significantly greater than the annual STE limit. OSD officials indicated that FFRDC related work must be deferred to later years when these limits are reached, since there are no other legally compliant alternatives capable of fulfilling these requirements.

Infrastructure: FFRDC officials we interviewed identified infrastructure challenges—including aging facilities and equipment—as hindering their research and development efforts. For example, many buildings at the Massachusetts Institute of Technology (MIT) Lincoln Laboratory are over 60 years old; MIT considers over half of them to be in substandard condition. According to an MIT official, these facilities, located on government property, were not structurally designed for modern research and have relatively poor vibration isolation, resulting in inefficient workarounds or work that could not be performed. Officials from the Defense Laboratories Office noted that the MIT Lincoln Laboratory is unique among DOD's FFRDCs in that it is operated on government-owned property.

³⁸DOD FFRDCs work within an annual ceiling of staff years of technical effort (STE), defined as a certain number of hours of paid effort for technical services. Another measure of employment is full-time equivalent (FTE) employment, which is defined in Office of Management and Budget (OMB) Circular A-11 as the total number of hours worked divided by the number of compensable hours applicable to the fiscal year. STE differs from FTE in that it specifies technical services and a fixed number of hours per fiscal year whereas FTE includes all work activity and is based on the total hours available in any particular fiscal year.

³⁹GAO, *Federal Research: Opportunities Exist to Improve the Management and Oversight of Federally Funded Research and Development Centers*, [GAO-09-15](#) (Washington, D.C.: Oct. 8, 2008).

A 2013 study, conducted on behalf of the White House Office of Science and Technology Policy, found that lab infrastructure project funding proposals must compete with hospitals, barracks, runways, and roads and, therefore, tend to be lower on the priority list for military construction funding.⁴⁰ A 2017 Defense Science Board report and DOD officials we spoke with indicated this continues to be true. While contract research centers have significant flexibility to execute infrastructure work, they are still affected by limited availability of military construction funding. Officials at another center noted that in some instances, DOD sponsors have been unable or slow to provide required secure facilities and equipment within needed time frames. Delays of this nature can affect the research centers' ability to deliver the technologies or related services needed by DOD.

Energy and Space Research Centers Follow Different Governance Approaches, but Exhibit Similar Benefits and Challenges

The Department of Energy (Energy) primarily relies on contractor-operated FFRDCs to operate its labs, while the majority of NASA labs and centers are government-operated. Energy's national labs form the core of the agency's scientific work and mission. This is in contrast to DOD-funded labs, which constitute a relatively small aspect of DOD's overall mission. We have previously found that Energy's labs can use funding for minor infrastructure improvements.⁴¹ NASA centers can also approve and fund certain facility projects, in accordance with NASA policies, and they have encountered significant challenges with aging infrastructure. Also, in some cases, energy and space research centers have significant challenges with hiring replacement staff and competing with private sector employers for staff. Energy's labs can hire scientific personnel with the flexibility of private companies, while NASA centers were previously provided hiring flexibilities by Congress in 2004 to facilitate staff hiring.

⁴⁰Institute for Defense Analyses, "A Study of Facilities and Infrastructure Planning, Prioritization, and Assessment at Federal Security Laboratories (Revised)" (February 2013); and Defense Science Board, "Defense Research Enterprise Assessment" (Jan. 25, 2017).

⁴¹GAO, *Federal Research: Information on DOE's Laboratory-Directed Research and Development Program*, [GAO-16-486R](#) (Washington, D.C.: Apr. 6, 2016).

While Energy and NASA’s research entities follow their specific governance models, there are broad characteristics common across these agencies as well as DOD. Table 2 illustrates that while research centers are largely government-owned, the government is not always the operator.

Table 2: Governance Models of Federally Funded or Sponsored Research Labs

Governance Structure	Characteristics	Examples
Government Owned and Operated	<ul style="list-style-type: none"> Managed by agency leadership. Facilities are owned or leased by the federal government. Predominately staffed by federal employees. 	<ul style="list-style-type: none"> Military service labs such as Air Force Research Laboratory Army research, development and engineering centers Navy warfare centers National Aeronautics and Space Administration (NASA) research centers Department of Energy National Energy Technology Laboratory
Government Sponsored and Contractor Operated	<ul style="list-style-type: none"> Managed and operated by contractors such as universities, private companies, nonprofit organizations, or consortia thereof. Funded by the federal government. Operated using facilities and equipment owned by private entities or the federal government. Staff are not federal employees and can assert copyrights, consult with industry, and participate in startups based on technology developed at the laboratory. 	<ul style="list-style-type: none"> Department of Defense (DOD) Sponsored FFRDCs and UARCs Energy national labs which operate as FFRDCs NASA Jet Propulsion Laboratory

Source: GAO review of DOD, Energy, and NASA documentation. | GAO-19-64

Department of Energy Primarily Uses Contractors to Operate National Labs and Manage Scientific Expertise

As we have reported, Department of Energy national labs are primarily operated by for-profit, non-profit and university FFRDC contractors using management and operating contracts, which are competed on a limited basis.⁴² Energy’s funding sponsors and headquarters officials are required to reevaluate FFRDC performance in increments not to exceed 5 years by federal acquisition regulations, which inform future decisions to renew the agreement. In 1990, we designated Energy’s contract

⁴²GAO, *Department of Energy: Actions Needed to Strengthen Acquisition Planning for Management and Operating Contracts*, [GAO-16-529](#) (Washington, D.C.: Aug. 9, 2016).

management—including both contract administration and project management—a high-risk area because of Energy’s inadequate management and oversight of contractors, leaving the department vulnerable to fraud, waste, abuse, and mismanagement.⁴³ In 2009, we subsequently narrowed the focus of Energy’s high-risk designation to the National Nuclear Security Administration and Office of Environmental Management, which together oversee four national labs. Further, in our 2017 High Risk report, we found that these two agencies had made progress in addressing our contract management concerns, but we identified continued problems with the agencies having sufficient capacity to mitigate contract and project management risks. Also, we found that they had demonstrated little progress in addressing contract management challenges, particularly in the area of financial management.⁴⁴

Energy’s Lab Contractors Manage Nearly All the Agency’s Scientific Expertise

The Department of Energy uses performance-based management and operating contracts, which have been subject to limited competition, with universities, non-profit companies and for-profit companies to operate the national labs on government-owned property. These contractor-operated FFRDCs provide the vast majority of Energy’s science and technology capacity, rather than supplementing the work of government-operated labs like DOD’s FFRDCs. Energy has depended on the expertise of private organizations to execute its science and technology work since the Manhattan Project produced the first atomic bomb during World War II.

The primary focus of each lab varies based on its expertise and facilities. Energy largely oversees its lab contractors through its headquarters program offices, which include the National Nuclear Security Administration, Office of Science, the Office of Fossil Energy, as well as co-located government field offices. Office of Science-sponsored labs primarily support scientific research for energy and physical sciences, while the National Nuclear Security Administration-sponsored (NNSA) labs primarily focus on nuclear weapons and related science and

Spallation Neutron Source at Oak Ridge National Laboratory



The Spallation Neutron Source is an experimental research facility at Oak Ridge National Laboratory—a government-owned contractor-operated laboratory. The Spallation Neutron Source includes the world’s most powerful pulsed-neutron sources and provides information about the structure and properties of materials that cannot be obtained by other means. The Spallation Neutron Source is a user facility whereby researchers from universities, national laboratories, and industry submit proposals, which are peer-reviewed and must compete for time at the user facility.

Source: UT-Battelle, LLC. | GAO-19-64

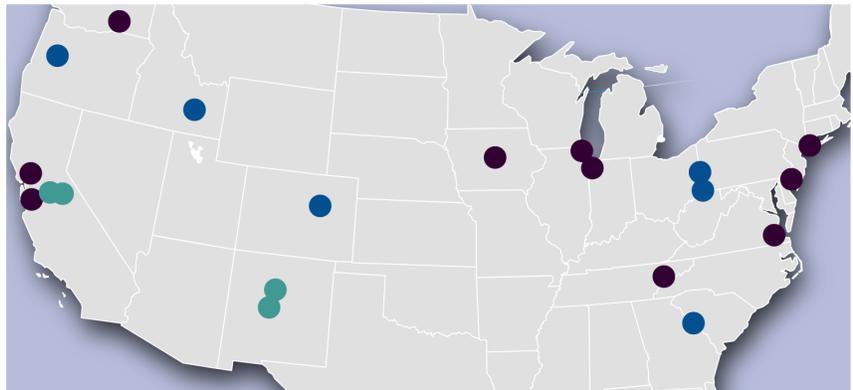
⁴³GAO, *High-Risk Series: An Update*, [GAO-09-271](#) (Washington, D.C.: January 2009).

⁴⁴GAO, *High-Risk Series: Progress on Many High-Risk Areas, While Substantial Efforts Needed on Others*, [GAO-17-317](#) (Washington, D.C.: Feb. 15, 2017).

technologies.⁴⁵ Energy also oversees its lab contractors' activities through on-site Energy oversight offices that work alongside lab management at each FFRDC. Some labs specialize in earlier-phase science, while other labs work on later-phase nuclear weapons technologies in addition to earlier-phase science. As Figure 10 shows, these labs are spread across the United States.

⁴⁵[GAO-16-529](#).

Figure 10: Department of Energy National Lab Locations



Office of Science Labs

- Ames Laboratory,**
Ames, Iowa
- Argonne National Laboratory,**
Argonne, Illinois
- Brookhaven National Laboratory,**
Upton, New York
- Fermi National Accelerator Laboratory,**
Batavia, Illinois
- Lawrence Berkeley Laboratory,**
Berkeley, California
- Oak Ridge National Laboratory,**
Oak Ridge, Tennessee
- Pacific Northwest National Laboratory,**
Richland, Washington
- Princeton Plasma Physics Laboratory,**
Princeton, New Jersey
- SLAC National Accelerator Laboratory,**
Menlo Park, California
- Thomas Jefferson National Accelerator Facility,**
Newport News, Virginia

Other Department of Energy Labs

- Idaho National Laboratory,**
Idaho Falls, Idaho
- National Energy Technology Laboratory,**
Morgantown, West Virginia
Pittsburgh, Pennsylvania
Albany, Oregon
- National Renewable Energy Laboratory,**
Golden, Colorado
- Savannah River National Laboratory,**
Aiken, South Carolina

National Nuclear Security Administration Labs

- Lawrence Livermore National Laboratory,**
Livermore, California
- Los Alamos National Laboratory,**
Los Alamos, New Mexico
- Sandia National Laboratories,**
Albuquerque, New Mexico
Livermore, California

Source: Department of Energy Office of Science. | GAO-19-64

Energy has only one government-operated and government-owned lab, the National Energy Technology Laboratory. Key differences between Energy’s contractor-operated and government-operated governance models are described in table 3.

Table 3: Models for Energy National Lab Governance

Lab Type	Operator	Oversight Authorities	Some Relevant Authorities	Operating Characteristics
<u>Primary Energy lab governance model</u> Contractor-operated national lab FFRDCs (16 labs)	<ul style="list-style-type: none"> Consist of non-profit, for-profit and non-profit university contractors; Government-owned property. Competed contracts with 5-year base terms, some of which include up to twenty 15-year award terms. 	<ul style="list-style-type: none"> Oversight by Energy Headquarters offices, sponsoring each lab, funding sponsors, and co-located Energy government oversight staff. Includes annual and 5-year reviews. 	<ul style="list-style-type: none"> 48 C.F.R. 970.1706 FAR subpart 17.6 42 U.S.C. §§ 2011 and 15801 	<ul style="list-style-type: none"> Perform work for industry and other government agencies, although Energy's oversight staff must approve it.
<u>Secondary Energy lab governance model</u> Government-operated National Energy Technology Laboratory	<ul style="list-style-type: none"> Government- led and operated lab. 	<ul style="list-style-type: none"> Primary oversight by Energy's Office of Fossil Energy. Funding sponsors provide oversight for their individual projects. 	<ul style="list-style-type: none"> 42 U.S.C. §§ 2011 and 15801 	<ul style="list-style-type: none"> Collaborates with other federal agencies on science and technology efforts. Lab management officials indicated hiring of replacement government staff is restricted. Highly dependent on contractor staff.

Source: GAO Presentation of Department of Energy data. | GAO-19-64

Energy's Lab Staff Are Hired and Compensated as Contractor Employees

Energy's FFRDCs use their own personnel systems, which Energy officials stated provide more flexibility for hiring and retaining qualified staff. Management within these FFRDCs can move staff in or out of scientific areas more quickly than government labs can, thereby providing greater agility to meet Energy's needs in emerging science areas. For example, Energy's lab oversight staff at Oak Ridge National Laboratory told us that use of lab contractors' human resources management systems allows for workforce flexibilities to meet Energy's needs. While these contractors have leeway in managing their human resources systems, Energy's headquarters maintains oversight—through its contracting officers—over employee compensation.

FFRDC Contractors Manage Most Energy Labs' Infrastructure

Energy's FFRDC contractors manage and operate nearly all of the department's government-owned national lab facilities—including day-to-day management of government-controlled facilities and real property.

Lab operators used funding to complete minor construction projects, which cost \$10 million or less.⁴⁶ This funding comes from a percentage of science and technology projects' funding, requires local Energy oversight office approval, and has streamlined project management requirements. In contrast, major infrastructure upgrades are funded through relatively long and complex line-item funding processes, and projects over \$50 million are subject to more rigorous project management requirements.

Energy's Lab Contractors Have Limited Discretion to Initiate Scientific Projects

Energy's labs use a small portion of their funding to initiate discretionary projects for science and technologies that will benefit sponsors in the long-term by maintaining the scientific and technical vitality of the laboratories. To maintain and enhance lab expertise, the National Defense Authorization Act for Fiscal Year 1991 authorized Energy's contractor-operated labs receiving funding for national security programs to use a percentage of lab funds to perform lab-directed R&D of a creative and innovative nature.⁴⁷ The actual percentages allowed to be used for lab-directed R&D are subject to Energy's approval.

Energy's entities sponsor most national lab projects based on their needs and lab expertise. Typically, earlier foundational science projects are funded through a process whereby funding sponsors issue calls for proposals to Energy's national labs. Interested scientific teams at labs provide proposals to conduct these projects for sponsor consideration. Sponsors then assess proposals for scientific merit and decide which teams receive funding to execute their projects. NNSA provides funding for later-phase nuclear technology development projects to its labs after agreement is made regarding objectives and deliverables for specific projects, according to Lawrence Livermore National Laboratory officials.

⁴⁶In 2017, the minor construction spending threshold was raised from \$10 million to \$20 million.

⁴⁷GAO, *Federal Research: Information on DOE's Laboratory-Directed Research and Development Program*, [GAO-16-486R](#) (Washington, D.C.: Apr. 8, 2016).

Energy's Lab Officials Identified Challenges Despite Management Flexibilities

Despite their flexibilities with regard to hiring and infrastructure decisions compared to government operated labs, Energy's lab leadership and government oversight officials noted human resource and facilities related challenges, such as:

- **Sufficiently compensating staff located in high-cost of living areas.** For example, the labor market of the San Francisco area, where several Department of Energy national labs are located, is highly competitive for employers. Commercial firms offer salaries and compensation that typically exceed those of government-funded, contractor-operated labs, although Energy's contractors have more pay flexibility than is allowed for Energy's government employees.
- **Obtaining government clearances in a timely manner.** Energy's NNSA oversight officials and lab management staff, in particular, cited this challenge, which they stated has led to a backlog of people needing clearances.
- **Government hiring freeze constraining overall hiring.** Officials at Energy's government-operated National Energy Technology Laboratory reported that as a result of a government hiring freeze, the lab has increasingly hired private contractor staff to the point that more than half of the total lab staff is now comprised of contractor employees.
- **Major infrastructure challenges at Energy labs.** Energy reported in July 2018 that over half of all national lab buildings are in either substandard or inadequate condition. The Energy Inspector General also identified infrastructure modernization as one of Energy's top management challenges.⁴⁸ This finding followed a mandated commission's report in 2015 that facilities and infrastructure across Energy's national lab network were hampered by high levels of deferred maintenance and excess facilities.⁴⁹

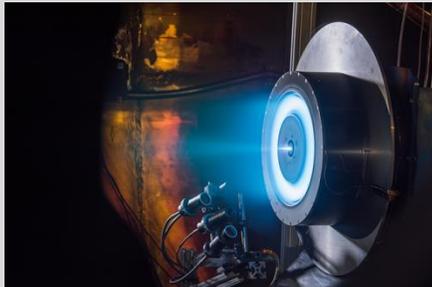
⁴⁸Department of Energy Inspector General, *Management Challenges at the Department of Energy— Fiscal Year 2018*, OIG-18-09 (Washington, D.C.: Nov. 27, 2017) Department of Energy Inspector General, *Management Challenges at the Department of Energy— Fiscal Year 2017*, OIG-SR-17-02 (Washington, D.C.: Nov. 16, 2016), and Department of Energy Inspector General, *Management Challenges at the Department of Energy— Fiscal Year 2016*, OIG-SR-16-01 (Washington, D.C.: Nov. 16, 2015).

⁴⁹Office of the Secretary of Energy, *Securing America's Future: Realizing the Potential of the Department of Energy's National Laboratories* (Washington, D.C.: Oct. 2015).

NASA Research Centers Are Primarily Governed as Government-Operated Entities

The majority of NASA’s science and technology facilities are operated within the governance framework of government-operated research centers, similarly to most DOD labs. While government-operated, they have been granted additional legislative flexibilities for hiring employees beyond those normally available to government entities.

National Aeronautics and Space Administration (NASA) Solar Electric Propulsion Project



The NASA Glenn Research Center—a government-operated laboratory—is currently developing solar electric propulsion technologies intended to allow manned and unmanned spacecraft to be propelled far beyond earth orbit using solar power. This project is developing large, flexible, radiation-resistant solar arrays that can be unfurled to capture solar energy powering fuel-efficient electrostatic thrusters. Scientists expect a system-level flight test within the next decade to demonstrate key technologies supporting NASA’s Lunar Orbital Platform-Gateway project, a platform to mature necessary short- and long-duration deep space exploration capabilities.

Source: NASA. | GAO-19-64

NASA locates its science and technology staff at four government-operated research centers, one contractor-operated FFRDC, and at five NASA centers assisting space and space flight development. These centers and the Jet Propulsion Laboratory—NASA’s sole sponsored FFRDC—execute NASA’s research missions including technology development in exploration and aeronautics. The differences between these two governance approaches are described in Table 4. NASA also works with Johns Hopkins University Applied Physics Lab, a UARC, to develop major space flight missions.

Table 4: NASA Research Center and Lab Governance Models

Lab Type	Operator	Oversight Authorities	Some relevant authorities	Operating Characteristics
<p><u>Primary NASA Lab Governance Model</u>^a</p> <p>NASA Research Centers (4 centers)</p>	<ul style="list-style-type: none"> Government-operated lab 	<ul style="list-style-type: none"> Oversight by NASA Headquarters, including funding sponsors providing oversight for their individual projects. 	<ul style="list-style-type: none"> Title 51, Chapters 201 and 203 of U.S. Code 	<ul style="list-style-type: none"> Collaborates on science and technology efforts with DOD and other organizations, including use of NASA lab and test facilities.

Lab Type	Operator	Oversight Authorities	Some relevant authorities	Operating Characteristics
<p><u>Secondary NASA Lab Governance Model</u></p> <p>University-contractor operated Jet Propulsion Laboratory</p>	<ul style="list-style-type: none"> Operated by university contractor having sole source contract. Government-owned property (originally part of DOD). 5-year contract renewable to 10 years total. 	<ul style="list-style-type: none"> Oversight by NASA Headquarters, including funding sponsors providing oversight for their individual projects. Overseen by locally based NASA oversight staff. 	<ul style="list-style-type: none"> Title 51, Chapters 201 and 203 of U.S. Code; 10 U.S.C. § 2304 (c) (3)(B)^b; Federal Acquisition Regulation § 35.017 	<ul style="list-style-type: none"> Not permitted to compete against industry, except for operation of an FFRDC. May work for non-NASA sponsors seeking FFRDC assistance with NASA approval.

Source: GAO Presentation of NASA data. | GAO-19-64

^a“Lab” as used in this context refers to science and technology organizations equivalent to NASA Research Centers, DOD UARCs and FFRDCs.

^bNASA uses FAR 6.302-3(a)(2)(ii) for awarding sole source contracts to the Jet Propulsion Laboratory.

Mission leadership officials at NASA Headquarters—including the Associate Administrators for Aeronautics Research, Human Exploration, Science and Space Technology—oversee NASA’s research centers as well as the Jet Propulsion Laboratory. These officials are responsible for technology programs providing funds to research centers and the Jet Propulsion Laboratory to support their specific mission areas. NASA’s science and technology project portfolios are based on the requirements and priorities established by NASA’s leaders in collaboration with key stakeholders in academia and industry among others. In planning their science and technology work, NASA’s Glenn Research Center officials noted that NASA research center directors consider the capabilities and resources—including staff and facilities—of other research centers to minimize redundant work.

NASA Has Flexibilities for Managing Its Scientist Workforce

NASA depends on a highly skilled civil servant and contractor workforce to plan and execute its missions. Congress provided NASA with additional human resource authorities beyond those otherwise allowed for federal government personnel through the NASA Flexibility Act of 2004. We found in September 2008 that NASA sought this flexibility to ensure that it could hire and retain the workforce it desired.⁵⁰ This law consisted of multiple provisions to address a range of human capital challenges and to strengthen all levels of the workforce. The provisions included incentives—including compensation—to allow NASA to compete

⁵⁰ GAO, *NASA Workforce: Briefing on National Aeronautics and Space Administration’s Use of Term Appointments*, [GAO-08-920R](#) (Washington, D.C.: Sept. 10, 2008).

successfully in the labor market with the private sector and reshape its workforce more effectively to support the Agency's mission. NASA also employs a significant contractor workforce across its different centers.

NASA Scientific Projects Are Mostly Funded According to NASA's Priorities

Glenn Research Center officials we interviewed stated their portfolio of science and technology projects—and funding—mostly aligns with NASA's top requirements and priorities. They, along with NASA sponsors, create technology roadmaps and investment plans to determine their future projects. NASA policy requires that NASA's scientific teams offer proposals for potential research and science and technology projects. This is similar in some ways to how many DOD and Energy centers must find sponsors willing to fund specific technology development projects, rather than receiving technology development funding for a given year. These proposals are reviewed by peer review teams, who identify for selecting officials those proposals they believe have the most scientific merit. Ames Research Center officials said they believe this process can foster innovation, encourage employees to keep skills honed, and mitigate complacency.

Glenn Research Center officials said that while most of the work they conduct is for sponsored applied research or advanced technology development, about 2 percent of their science and technology budget is spent on early-stage scientific innovation. Recommended projects of this nature proposed by the research center are typically approved by headquarters officials, according to these Glenn officials. NASA provides technical grants for basic research and applied science to university scientists nationwide on a competitive basis, and also funds similar research done internally at research centers.

NASA Officials Identified Workforce and Infrastructure Challenges

As with DOD and Energy's research centers, NASA officials have identified some key operating challenges, including:

- **Aging infrastructure and facilities.** The NASA Inspector General listed infrastructure area as one of the top five management and performance challenges facing NASA. Further, the Inspector General identified deficiencies with facilities planning and reported that about 80 percent of facilities at three of four NASA research centers are over 50 years old, while about half of the facilities at the Jet

Propulsion Laboratory and the fourth research center are that old.⁵¹ Infrastructure projects and upgrades of \$1 million or less are undertaken by research center management instead of at the NASA headquarters level. Construction above this threshold has significantly more requirements and is approved by NASA headquarters. Glenn Research Center officials indicated it is difficult to obtain funding for projects that exceed the minor infrastructure threshold, in part, due competition with major construction of facilities proposals from across the agency for limited funds. As a result, they put most of their efforts into sustaining existing infrastructure.

- **Workforce shortages in key technical areas.** As we found in May 2018, NASA has experienced workforce challenges on several major projects such as the Mars 2020 and Europa Clipper projects.⁵² Also, over 40 percent of NASA’s workforce is either eligible to retire now or will be eligible in the next 5 years. NASA headquarters officials noted that NASA’s workforce is aging because NASA has a low attrition rate—about 4 percent annually—and high numbers of staff stay several years beyond retirement. Further, in 2017, the NASA Inspector General found gaps in NASA’s workforce planning for specific capability areas and how workforce plans would meet future needs, and recommended that NASA establish standardized guidance defining the data and analyses for these planning efforts. NASA concurred with and identified its plan to implement this recommendation.⁵³ However, NASA has not implemented this recommendation, according to the NASA Inspector General’s latest semiannual report to Congress.⁵⁴

Conclusions

Congress provided DOD lab directors with key authorities to foster targeted, timely investments in the most pressing technology areas. Lab

⁵¹National Aeronautics and Space Administration Office of Inspector General, *NASA’s Efforts to “Rightsize” Its Workforce, Facilities, and Other Supporting Assets*, IG-17-015 (Washington, D.C.: Mar. 21, 2017).

⁵²GAO, *NASA: Assessments of Major Projects*, [GAO-18-280SP](#) (Washington, D.C.: May 1, 2018).

⁵³NASA IG Report 17-015.

⁵⁴National Aeronautics and Space Administration Office of Inspector General, *Semiannual Report October 1, 2017-March 31, 2018*, (Washington, D.C.: Apr. 30, 2018).

directors have used these authorities—such as laboratory initiated research and direct hire authorities—to varying degrees, but more needs to be done to facilitate innovation and efficiency. Specifically, service specific obstacles in the Air Force, Navy, and Army impede lab directors from capitalizing on laboratory initiated research authority to a greater extent. Service leadership can take actions to better understand and potentially remove barriers to more fully use laboratory initiated research tools.

Recommendations for Executive Action

We are making the following three recommendations to DOD:

The Secretary of the Air Force should assess the potential costs and benefits of implementing accounting system improvements that would allow the Air Force Research Laboratory to charge customers a fixed percentage fee on provided science and technology activities to the extent allowed under the laboratory initiated research authority. (Recommendation 1)

The Secretary of the Navy should clarify whether and how to use the laboratory initiated research authority within the Capital Investment Program. (Recommendation 2)

The Secretary of the Army should assess existing Army policy for laboratory initiated research authority and determine whether to implement changes to eliminate disincentives for lab usage of the authority. (Recommendation 3)

Agency Comments

We provided a draft of this report to DOD, Energy, and NASA for review and comment. Energy and NASA did not provide any comments on the draft report. In DOD's written comments, reproduced in appendix III, DOD concurred with our three recommendations. Further, in its response to our third recommendation, DOD stated that the Army plans to initiate a study by January 2, 2019, regarding its use of the laboratory initiated research authority. According to DOD, the Army's study will identify potential opportunities for policy improvements.

We are sending copies of this report to the appropriate congressional committees and offices; the Secretary of Defense; the Secretaries of the

Army, Navy, and Air Force; the Secretary of Energy; and the NASA Administrator. In addition, the report will be made available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions concerning this report, please contact me at (202) 512-4841. Contact points for our offices of Congressional Relations and Public Affairs may be found on the last page of this report. Staff members making key contributions to the report are listed in appendix IV.

A handwritten signature in black ink, appearing to read "Michael J. Sullivan". The signature is fluid and cursive, with a large loop at the beginning and a long horizontal stroke at the end.

Michael J. Sullivan
Director, Contracting and National Security Acquisitions

List of Committees

The Honorable James M. Inhofe
Chairman
The Honorable Jack Reed
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Richard Shelby
Chairman
The Honorable Dick Durbin
Ranking Member
Subcommittee on Defense
Committee on Appropriations
United States Senate

The Honorable Mac Thornberry
Chairman
The Honorable Adam Smith
Ranking Member
Committee on Armed Services
House of Representatives

The Honorable Kay Granger
Chairwoman
The Honorable Pete Visclosky
Ranking Member
Subcommittee on Defense
Committee on Appropriations
House of Representatives

Appendix I: Objectives, Scope, and Methodology

This report examines (1) how the Department of Defense (DOD) labs have used selected legislative authorities to foster innovation and efficiency and identify what barriers impede their use; (2) identifies and describes governance models used by selected DOD-sponsored federally funded research centers and university affiliated research centers; and (3) identifies and describes governance models used non-defense labs, specifically at the Department of Energy (Energy) and National Aeronautics and Space Administration (NASA).

To address the first objective, we selected four specific authorities for our review based on previous work identifying science and technology best practices and expedited lab hiring:¹

- **Laboratory Initiated Research Authority.** The authority provided in Section 219 of the Duncan Hunter National Defense Authorization Act for Fiscal Year 2009, as implemented, provides lab directors with flexibility to fund projects in four allowable categories: basic and applied research; technology transition; workforce development; and revitalization, recapitalization, or repair or minor military construction of lab infrastructure.²
- **Laboratory Enhancement Pilot Program.** Section 233 of the National Defense Authorization Act for Fiscal Year 2017 established a pilot program for lab directors to propose alternative and innovative methods that might lead to more effectively managing and operating labs and authorized lab directors to waive any regulation, restriction, requirement, guidance, policy, procedure, or departmental instruction that would affect implementation of these methods unless such

¹GAO, *Defense Science and Technology: Adopting Best Practices Can Improve Innovations Investments and Management*, GAO-17-499 (Washington D.C.: June 29, 2017) and GAO, *DOD Personnel: Further Actions Needed to Strengthen Oversight and Coordination of Defense Laboratories' Hiring Efforts*, GAO-18-417 (Washington, D.C.: May 30, 2018).

²Pub. L. No. 110-417, § 219 (2008), as amended, codified at 10 U.S.C. § 2363.

implementation would be prohibited by a provision of an existing statute or common law.³

- **Direct Hire Authority.** Four types of direct hire authorities authorized by Congress since 2008 are intended to provide a streamlined and accelerated hiring process to allow the labs to successfully compete with private industry and academia for high-quality scientific, engineering, and technician talent.⁴
- **Micro-purchase Authority.** The Federal Acquisition Regulation states a preference for government agencies, to purchase and pay for micro-purchases of supplies or services using the government-wide commercial purchase card up to and at the micro-purchase threshold, but micro-purchases may be conducted using any of the simplified acquisition methods. While the FAR micro-purchase threshold was generally \$3,500 at the time of our review, Congress increased this threshold to \$10,000 for activities of DOD science and technology reinvention laboratories in Section 217 the National Defense Authorization Act for Fiscal Year 2017.⁵

Although Congress has provided additional legislative authorities to defense lab directors to address hiring, infrastructure, and technology transition challenges, the authorities that we covered in our review are the ones that our prior and current work have shown are currently, or have the potential to be, the most critical for supporting science and technology reinvention laboratories' innovation mission within DOD labs. DOD lab leaders use these authorities to flexibly fund projects intended to facilitate research and development; propose alternative and innovative methods that might lead to more effective lab management; directly hire personnel at DOD labs including students currently enrolled in science, technology, engineering, and mathematics (STEM) programs; and expand critical science and technology purchases using simplified acquisition methods.⁶

To identify the extent to which DOD laboratories have used these authorities as well as to identify what potential barriers existed to using

³Pub. L. No. 114-328 § 233 (2016), as amended (10 U.S.C. § 2358 (note)).

⁴10 U.S.C. § 1580 note; 10 U.S.C. § 2358a.

⁵Pub. L. No. 114-328 § 217 ((a) (2016), as codified at 10 U.S.C § 2339.

⁶DOD (STEM) positions include, among others, the following career categories: life sciences, computer sciences and information technology, mathematics and related sciences, and engineering.

these authorities, we administered a survey to 44 STRL directors (or their equivalent) to collect information on the use of these specific authorities, their perceptions about the effectiveness of those authorities, and their perceptions about any barriers to using these authorities. The members of the population surveyed were the 44 defense laboratories defined as science and technology reinvention laboratories. For the purposes of our review, we defined laboratories as inclusive of Air Force technical directorates (10), Army warfare centers (17), and Navy warfare centers (17). We emailed questionnaires to the laboratories beginning in late March 2018, and survey data collection ended in early May 2018, with 31 labs returning completed questionnaires, for an overall response rate of 71 percent at the laboratory level.

We took steps to minimize the potential errors that the practical difficulties of conducting any survey may introduce. *Nonresponse error* can result when a survey fails to capture information from all population members selected into a survey sample. Of the 13 questionnaires not returned, 4 were Army warfare centers, and 9 were Air Force research directorates. Throughout the data collection period, we made multiple follow-up attempts by email and phone to those labs not yet responding. The Air Force Research Laboratory (AFRL) provided a single survey response for the entire laboratory enterprise. Not all returned questionnaires may have answers to every question applicable to a respondent. However, this question-level nonresponse did not exceed one for any of the questions applicable to all 31 labs. Because we selected the entire population of laboratories for our survey, our estimates are not subject to *sampling error*. We developed our list of the 44 labs in our population in consultation with DOD, and are confident that none were left out, so our survey has no known sources of *coverage error*. We conducted pretests of the draft questionnaire with 3 laboratories in the population and made revisions to reduce the possibility of *measurement error* from differences in how questions were interpreted and the sources of information available to respondents. After reviewing the answers received, we also followed up as necessary with respondents to clarify apparent inconsistencies or other possible misreports, and made changes to responses where corrections were needed. A second, independent analyst checked the accuracy of all computer analyses to minimize the likelihood of *errors in data processing*.

To obtain additional information on this objective, we reviewed relevant legislation which established or amended these authorities and reviewed applicable DOD and service policy documentation. Further, we collected

military service related information on the usage of two authorities, such as:

- Spending data on the use of the laboratory initiated research authority. We gathered this information from DOD-mandated reports to Congress on the use of this authority and military service officials. We determined these data to be reliable based on reviews of agency documentation collected and interviews with agency officials.
- Data on the usage of direct hire authorities by the service laboratories. We collected direct hire data from each of the military services including the number of direct hire authority candidates hired as well as the number of direct hire positions the laboratories were authorized to hire. We determined these data to be reliable based on reviews of agency documentation collected and interviews with agency officials. We also used select findings from our May 2018 report where we evaluated DOD's use of hiring authorities, including direct hire authority. More information about the scope and methodology of our prior work can be found in that report.⁷

In addition, we also collected information on military service proposals to utilize the laboratory enhancement pilot program authority.

To obtain further information on department- and service-level involvement in and perspectives of defense laboratory authorities and challenges, we interviewed officials responsible for the management, execution, and oversight of DOD's science and technology enterprise, including military service labs. At the Office of the Secretary of Defense and military department headquarters level, those responsible for the management and oversight of science and technology activities, we met with officials from the:

- Office of the Assistant Secretary of Defense for Research and Engineering;
- DOD Defense Laboratories Office;
- Office of the Deputy Assistant Secretary of the Army for Research and Technology;
- Office of the Deputy Assistant Secretary of the Air Force for Science, Technology, and Engineering;

⁷GAO, *DOD Personnel: Further Actions Needed to Strengthen Oversight and Coordination of Defense Laboratories' Hiring Efforts*, [GAO-18-417](#) (Washington, D.C.: May 30, 2018).

- Office of the Assistant Secretary of the Air Force for Financial Management and Comptroller;
- Office of the Deputy Assistant Secretary of the Navy for Research, Development, Test, and Evaluation; and
- Office of the Budget, within the Office of the Assistant Secretary of the Navy for Financial Management and Comptroller

We also met with military department lab officials responsible for the management and execution of science and technology activities from the:

- Army Research, Development and Engineering Command;
- Army Research Laboratory;
- Army Aviation and Missile Research, Development, and Engineering Center;
- Air Force Research Laboratory;
- Naval Research Laboratory;
- Naval Surface Warfare Center, Headquarters; and
- Naval Surface Warfare Center, Carderock Division

To identify and describe governance models used by selected DOD-sponsored federally funded research centers (FFRDCs) and university affiliated research centers (UARCs), we focused our review on the 3 FFRDCs designated as research and development labs as well as all 13 UARCS sponsored by DOD entities.⁸ We reviewed appropriate sections of the FAR language related to FFRDCs and UARCs, DOD guidance for working with FFRDCs and UARCs, relevant contracts, and performance assessments. Further, we met with officials from the office of the Deputy Director, OSD Studies and Federally Funded Research & Development Centers Management and Office to discuss overall FFRDC and UARC management, policies, and challenges facing FFRDCs and UARCs. We interviewed officials at selected research and development FFRDCs and UARCS to discuss their experience conducting DOD research and interactions with their customers, such as defense program executive offices. We met with officials at the two major research and development lab FFRDCs—The Lincoln Laboratory at the Massachusetts Institute of Technology (MIT) and the Software Engineering Institute at Carnegie

⁸DOD also sponsors 2 systems engineering and integration FFRDCs and 5 study and analysis FFRDCs.

Mellon University.⁹ We also selected a university affiliated research center sponsored by the Army and Navy: The Applied Physics Laboratory at Johns Hopkins University and the Institute for Soldier Nanotechnologies also at the MIT.¹⁰

To identify and describe governance models by non-defense labs, we selected Energy and NASA to focus our efforts. We identified 17 Energy national labs and 4 NASA research centers conducting basic and applied research similar to DOD labs. These agencies, along with DOD, represent 3 of the top 4 agencies in terms of average federal research and development spending from fiscal years 2015 to 2017. In our August 2016 GAO Technology Readiness Assessment Guide, we drew heavily from DOD, NASA, and Energy for best practices, terminology, and examples.¹¹ This contributed to our decision to focus on Energy and NASA's research entities in this laboratory governance review. We did not include the fourth agency—the National Institutes of Health—in our review because it is not as similar to DOD. We also reviewed relevant Energy and NASA guidance as well as relevant FAR sections.

At Energy, we met with officials from the National Nuclear Security Administration which is semi-autonomous entity within Energy responsible for managing the nation's nuclear weapons and nuclear security. We also met with Officials from the Office of Science, a program office responsible for supporting energy related fundamental science and research. To gain further insights on operating structures, funding arrangements, and their overall experience we met with lab leadership at selected Energy labs which were chosen based on initial discussions with agency officials and our review of past GAO work:

- Oak Ridge National Laboratory,
- Lawrence Berkeley National Laboratory,

⁹We did not meet with officials from the other research and development laboratory FFRDC, the Center for Communications and Computing, as this entity is sponsored by the National Security Agency and comprised a very small portion—less than 8 percent—of R&D FFRDC spending.

¹⁰The Air Force did not have an active contract with a university affiliated research center at the time of our review.

¹¹GAO, *GAO Technology Readiness Assessment Guide: Best Practices for Evaluating the Readiness of Technology for Use in Acquisition Programs and Projects—Exposure Draft*, [GAO-16-410G](#) (Washington, D.C.: Aug. 11, 2016).

- Lawrence Livermore National Laboratory, and
- National Energy Technology Laboratory (the sole Energy government owned and operated laboratory)

We also met with leadership from Battelle Memorial Institute, which is the sole or joint contract manager for five Energy national labs including Oak Ridge National Laboratory. In addition, Battelle is an integrated subcontractor at Lawrence Livermore National Laboratory.

At NASA, we met with officials with NASA's Science Mission Directorate and Mission Support Directorate to discuss overall research center management and operations.¹² We also leveraged ongoing and recently completed work at GAO to gain additional insight on NASA's operations such as human capital management. Almost all of NASA's research, space, and space flight centers conduct research and development activities. However, we focused our review on four research centers where NASA primarily conducts its aeronautics research, which has substantial overlap with DOD activities. To gain additional insight into the experience of lab leaders at NASA research centers, we met with officials at NASA's Glenn Research Center and Ames Research Center. In addition, we also met with officials at the NASA Jet Propulsion Center, which is the only NASA-sponsored FFRDC.

We conducted this performance audit from July 2017 to December 2018 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

¹²We focused our review on NASA laboratory governance and did not evaluate NASA's technology development efforts. Accordingly, we did not interview NASA Space Technology Mission Directorate officials.

Appendix II: Funding for Selected External DOD Sponsored Research Centers

Table 5: DOD Funding for Lab Federally Funded Research and Development Center (FFRDC) and University Affiliated Research Centers (UARC), Fiscal Year 2016 and Fiscal Year 2017 (then-year dollars in millions)

n/a Parent Institution	n/a Research Center	n/a Primary Sponsor	DOD Funding (dollars in millions)	
			Fiscal year 2016	Fiscal year 2017
Lab FFRDCs:				
Lab FFRDCs: Massachusetts Institute of Technology	Lincoln Laboratory	Office of the Secretary of Defense (OSD)	694.7	689.3
Lab FFRDCs: Carnegie Mellon University	Software Engineering Institute	OSD	134.2	143.6
Lab FFRDCs: Institute for Defense Analyses	Center for Communications and Computing	National Security Agency	64.4	66.5
n/a	Lab FFRDC Subtotal		893.3	899.4
UARCs: Johns Hopkins University	Applied Physics Laboratory	U.S. Navy	120.2	58.5
UARCs: Pennsylvania State University	Applied Research Laboratory	U.S. Navy	53.4	63.8
UARCs: University of Texas	Applied Research Laboratory	U.S. Navy	11.5	13.7
UARCs: University of Washington	Applied Physics Laboratory	U.S. Navy	2.8	1.8
UARCs: University of Hawaii	Applied Research Laboratory	U.S. Navy	8.0	1.2
UARCs: Georgia Institute of Technology	Georgia Tech Research Institute	U.S. Army	85.4	70.0
UARCs: University of Southern California	Institute for Creative Technologies	U.S. Army	23.2	27.1
UARCs: Massachusetts Institute of Technology	Institute for Soldier Nanotechnologies	U.S. Army	7.9	7.7
UARCs: University of California, Santa Barbara	Institute for Collaborative Biotechnologies	U.S. Army	11.0	9.2
UARCs: Utah State University	Space Dynamics Laboratory	Missile Defense Agency	57.7	78.7
UARCs: University of Maryland	Center for Advanced Study of Language	National Security Agency	5.6	2.5
UARCs: Stevens Institute of Technology	Systems Engineering Research Center	OSD	7.5	7.4

**Appendix II: Funding for Selected External
DOD Sponsored Research Centers**

n/a Parent Institution	n/a Research Center	n/a Primary Sponsor	DOD Funding (dollars in millions)	
			Fiscal year 2016	Fiscal year 2017
UARCs: University of Nebraska	National Strategic Research Institute	US Strategic Command	16.0	8.5
n/a	UARC Subtotal		410.2	350.1
n/a	Grand Total: DOD Funding at DOD Contractor-operated Research Centers		1,303.5	1,249.5

Source: OSD Studies and FFRDC Management Office | GAO-19-64

Appendix III: Comments from the Department of Defense

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of Defense



RESEARCH
AND ENGINEERING

OFFICE OF THE UNDER SECRETARY OF DEFENSE
3030 DEFENSE PENTAGON
WASHINGTON, DC 20301-3030

Mr. Michael J. Sullivan
Director, Contracting and National Security Acquisitions
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Mr. Sullivan,

This is the Department of Defense (DoD) response to the Government Accountability Office (GAO) Draft Report, GAO-19-64, "DEFENSE SCIENCE AND TECHNOLOGY: Actions Needed to Enhance Use of Laboratory Initiated Research Authority," dated November 1, 2018 (GAO Code 102174). The DoD concurs with each of the three recommendations provided by GAO in the GAO Draft Report, GAO-19-64. The DoD response is provided as an enclosure to this letter.

The point of contact concerning this matter is Wendy Milonovich, whom you may reach at (571) 372-6377 or by email at wendy.l.milonovich.ctr@mail.mil.

Sincerely,

A handwritten signature in black ink, appearing to read "Jagadeesh Pamulapati".

Jagadeesh Pamulapati
Director, Defense Laboratory Office

Enclosure:
As stated

GAO DRAFT REPORT DATED NOVEMBER 1, 2018
GAO-19-64 (GAO CODE 102174)

“DEFENSE SCIENCE AND TECHNOLOGY: ACTIONS NEEDED TO ENHANCE USE
OF LABORATORY INITIATED RESEARCH AUTHORITY”

DEPARTMENT OF DEFENSE COMMENTS
TO THE GAO RECOMMENDATION

RECOMMENDATION 1: The GAO recommends that the Secretary of the Air Force should assess the potential costs and benefits of implementing accounting system improvements that would allow the Air Force Research Laboratory to charge customers a fixed percentage fee on provided services and activities to the extent allowed under the laboratory initiated research authority.

DoD RESPONSE: The DoD concurs without comment.

RECOMMENDATION 2: The GAO recommends that the Secretary of the Navy should clarify whether and how to use the laboratory initiated research authority within the Capital Investment Program.

DoD RESPONSE: The DoD concurs without comment.

RECOMMENDATION 3: The GAO recommends that the Secretary of the Army should assess existing Army policy for laboratory initiated research authority and determine whether to implement changes to eliminate disincentives for lab usage of the authority.

DoD RESPONSE: The DoD concurs and the Army will take action to initiate a study, by 2 January 2019, regarding the Army laboratories' use of title 10, United States Code, section 2363 and to identify potential opportunities for policy improvements.

Appendix IV: GAO Contact and Staff Acknowledgments

GAO Contact

Michael J. Sullivan, (202) 512-4841 or sullivanm@gao.gov

Staff Acknowledgments

In addition to the contact named above, Christopher R. Durbin (Assistant Director); Charlie Shivers, III (Analyst-in-Charge); Emily Bond; Lorraine Ettaro; Carl Ramirez; Sylvia Schatz; Sean Seales; Brian Smith; and Robin Wilson made significant contributions to this report.

Appendix V: Accessible Data

Data Tables

Accessible Data for Figure 3: DOD, Energy, and NASA Together Accounted for About 66 Percent of Total Federal Research and Development Spending on Average from Fiscal Years 2015 to 2017 (Dollars in Billions)

Category	Department of Defense	National Aeronautics and Space Administration	Department of Energy	National Institutes of Health	Other
Percent	48	9	9	22	12

Accessible Data for Figure 4: In Fiscal Year 2017, Military Department Labs Did Not Maximize Use of Laboratory Initiated Research Authority

Military department	Actual assessed or charged percentage fee	Difference between maximum allowable and actual assessed or charged percentage fee
Army	2.9	1.1
Air Force	3	1
Navy	1	3

Accessible Data for Figure 5: Military Department Labs Used Laboratory Initiated Research Authority Funds in Fiscal Year 2017 to Fund Projects across the Four Allowable Project Categories

Military department	Infrastructure	Basic & Applied Research	Workforce Development	Technology Transition
Navy	7.3	43.0	44.7	27.4
Air Force	32.9	29.8	11.9	0.0
Army	53.7	25.7	13.7	8.6

Accessible Data for Figure 6: Lab Directors GAO Surveyed Generally Reported That Laboratory Initiated Research Authority Is Useful for Fostering Innovation and Increasing Efficiency

n/a	Fostering Innovation	Increasing Efficiency

n/a	Extremely Useful	Very Useful	Extremely Useful	Very Useful
Basic & Applied Research	21	2	13	6
Technology Transition	12	10	9	10
Workforce Development	14	10	18	5
Infrastructure	12	5	18	4

Accessible Data for Figure 7: Lab Directors GAO Surveyed Responded That Direct Hire Authorities Are Useful for Fostering Innovation and Increasing Efficiency

n/a	Fostering Innovation		Increasing Efficiency	
	Number of Respondents		Number of Respondents	
Type of Direct Hire	Extremely Useful	Very Useful	Extremely Useful	Very Useful
Advanced Degree	24	6	22	8
Bachelor's Degree	15	13	22	5
Veterans	7	16	12	13
Science, Technology, Engineering, and Mathematics (STEM) Students	13	5	12	5

Accessible Data for Figure 8: Military Departments Did Not Use Direct Hire Authorities to the Maximum Extent Allowable in Calendar Years 2016 or 2017

Year	Type of Direct Hire	Hired	Authorized
2016	Advanced Degree	694	1387
2016	Bachelor Degree	1253	1119
2016	Veteran	188	1026
2017	Advanced Degree	508	1662
2017	Bachelor Degree	1321	1146
2017	Veteran	187	1157
2017	STEM Student	81	3833

Agency Comment Letter

Accessible Text for Appendix III: Comments from the Department of Defense

Page 1

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U.S. Government Accountability Office

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Washington, DC 20548

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Jagadeesh Pamulapati

Director, Defense Laboratory Office

Enclosure:

As stated

Page 2

GAO DRAFT REPORT DATED NOVEMBER 1, 2018 GAO-19-64 (GAO CODE 102174)

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